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DYE REMOVAL USING TREATED SUGARCANE BAGASSE: BREAKTHROUGH CURVE MODELING

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Abstract **- The use of cheap and ecofriendly adsorbents have been studied as an alternative substitution of activated carbon for the removal of dyes from wastewater. Agro-industrial waste like sugarcane bagasse has been used as an adsorbent to successfully remove methylene blue from an aqueous solution. This paper has investigated the potential use of sugarcane bagasse, pretreated with sulphuric acid, for the removal of methylene blue (MB) from wastewater. Batch experiments have confirmed the suitability of these treated bagasse to be used as an adsorbent for removal of MB dye by using Langmuir-Freundlich isotherm. Experiments were also conducted at various column heights, influent flow rates and influent concentrations. Breakthrough curves are plotted as per the varying parameters. The experimental data has been fitted in the widely used models for column adsorption operated in semi-continuous mode such as Thomas model and Bed Depth Service time (BDST) model. The model parameters so obtained can be used to scale up the process from laboratory-scale to a pilot-scale. Cost analysis of treated sugarcane bagasse with activated carbon has been made and it has been found that Sugarcane Bagasse is the most cost effective adsorbent for removal of dye from aqueous solutions.**

Keywords - Treated Sugarcane Bagasse,Thomas Model, Bed Depth Service Time Model, Breakthrough Curve Modeling

I. INTRODUCTION

Dyes have long been used in textile, paper and pulp, plastics, leather, cosmetics and food industries. Effluents generated from these industries contain different dyes and are most polluting in nature and the removal of these dyes present in effluents requires special attention. For this purpose the adsorption technique has gained much popularity due to its simplicity as well as the availability of a wide range of adsorbents and it is proved to be an effective and attractive process for the removal of non-biodegradable pollutants (including dyes) from wastewater. The process of adsorption has an edge over other processes due to its sludge-free clean operation and almost complete removal of dyes even from the most dilute solution. Most commercial systems use activated carbon as adsorbent to remove dyes from water because of its significant adsorption capacity. Although activated carbon is a preferred adsorbent yet its widespread use is restricted due to its cost.

This paper has investigated the potential use of sugarcane bagasse, pretreated with sulphuric acid for the removal of methylene blue (MB) from aqueous effluents. Experiments were conducted by varying column heights, influent flow rates and influent concentrations. Breakthrough curves are plotted as per the varying parameters. The experimental data have been fitted in some of the widely used models for column adsorption operated in semi-continuous mode such as Thomas model and Bed Depth Service time (BDST) model. The model parameters so obtained can be used to scale up the process from laboratory-scale to a pilot-scale.

Cost analysis of treated sugarcane bagasse with activated carbon has been made and it has been found that Sugarcane Bagasse is the most cost effective adsorbent for removal of dye from aqueous solutions.

A. Preparation of Adsorbent

After cutting into pieces (2-5 cm), the sugarcane bagasse is soaked in boiling water to remove its sugar content. Then sugarcane bagasse is dried and acid treatment is carried out with 98% sulphuric acid in 1:1 ratio and heated in an oven for 10-12 hours at 100-120 C.

This heated bagasse after washing with distilled water is then soaked in 1% Sodium bicarbonate overnight to remove the residual acid. It is then dried in the dryer at around 100 C for 24 hours.

B. Methods Adopted For Characterization of the bed particles

The bulk density was found to be 0.2238 g/cc or 223.8 kg/m3, which was obtained by simply filling a 1 litre container up to the brim and weighing it. The container was tared before weighing the sample.

The particle density was 0.412 g/cc, which is the weight of the adsorbent divided by the actual particle volume. The actual particle volume was determined by measuring the water displaced by the adsorbent mass.

Porosity= Void volume* Particle density/ (Void volume*Particle Density+1). Void volume was estimated by boiling a weighed sample immersed in water. The sample is then superficially dried and weighed. The increase in weight divided by the liquid density gives void volume. The porosity was calculated to be 0.45.

The material is ground and sieved, until the size between +10 to +20 mesh size is obtained and is used as the adsorbent. Particle diameter was calculated by taking the average of the pore diameters of 10 and 20 mesh from Tyler series. The diameter of adsorbent particles was found to be 1.425 mm.

II. EXPERIMENTAL APPROACH

A. Batch Experiments

Batch experiments were first carried out and data was analysed using Langmuir and Freundlich isotherms. It was found that this treated bagasse is a suitable adsorbent for removal of methylene blue dye from aqueous solution.

B. The Methodology used for Analysis of Methylene Blue

The collected samples were analyzed for concentration of dyein the solution using a colorimeter (Equiptronics EQ-650A, India). All the samples were diluted 20 times using water in order to obtain reading within the range of the colorimeter. The colorimeter analysis is done at the complementary wavelength (660 nm for methylene blue) at which a particular colored solution gives maximum absorbance. The wavelength was determined by plotting the absorption spectrums for Methylene Blue.

C. Fixed Bed Column Experiments

Breakthrough curves were determined from the fixed-bed adsorption with various column heights, influent flow rates and influent concentrations of MB dye in aqueous solution. Experiments were carried out for column heights of 7.5 cm and 15 cm, with the influent flow rates of 1 lit/hr and 0.5 lit/hr and influent concentrations of 200 mg/l and 300 mg/l of MB.

D. Experimental procedure

Column tests were performed in down-flow mode using an acrylic column of internal diameter of2.5 cm and a length of 100 cm.Breakthrough concentration of 20 mg/lit was set for the dye MB solution as per government standards [1]. The breakthrough curves data is used to find out the parameters of Thomas model and Bed Depth Service Time (BDST) model which can be used to design a scaled-up column for pilot or full scale operation. The parameters in both these models are the adsorptive capacity of the bed and the adsorption rate constant. The Thomas model and the BDST model are simple but very widely used models to estimate adsorptive capacity of the bed and predict breakthrough curves. If similar conditions are maintained in the small scale and full scale operation, these models can be accurately used for a scale up of the process.[2][3].When conditions differ greatly, the applicability of these models reduces.

III. RESULTS AND DISCUSSION

C_0 is the initial concentration of influent (mg/lit), C (mg/lit) is the concentration at given time t (min).A plot of C/Co vs time (mins) has been given in Fig. 1 for column heights of 7.5 cm (curve 1) and 15 cm (curve 2) for the flow rate of 1lit/hr and influent concentration of 200 mg/lit. It has been found that breakthrough time increases with increase in column height for a particular influent flow rate as well as concentration.

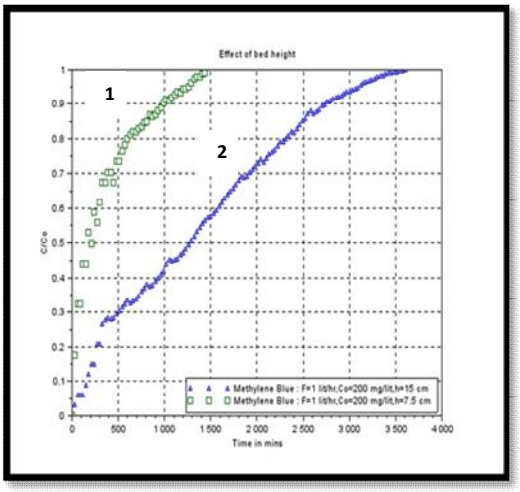

Fig 1. Breakthrough curves for different column heights

Similar plots have been made by varying the influent flow rates and its concentrations. Fig. 2. Shows the effect of influent flow rate on breakthrough curve of Methylene Blue. Fig. 3. Shows the effect of initial influent concentration on Methylene Blue breakthrough curve.

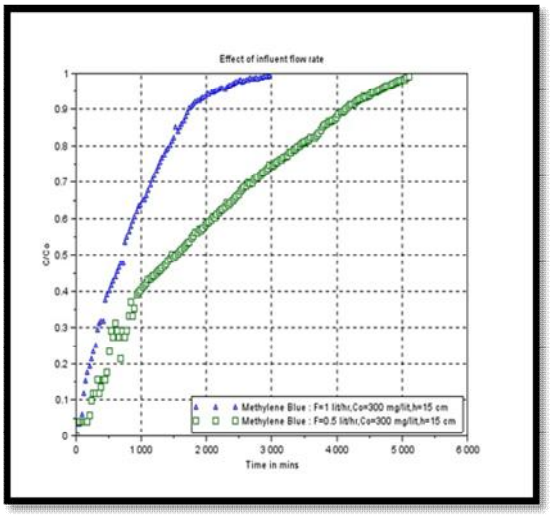

Fig.2 Effect of influent flow rate on breakthrough curve of Methylene Blue

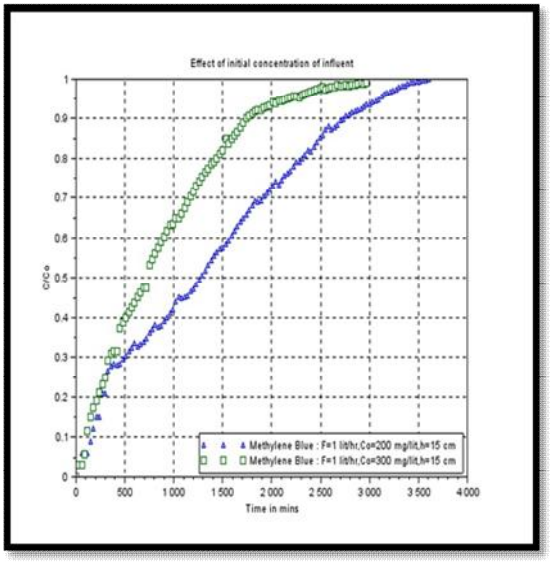

Fig. 3. Effect of initial influent concentration on Methylene Blue breakthrough curve

A. Application of Thomas Model

The Thomas model is given by

$$\ln\left(\frac{C_0}{C}-1\right)=\frac{k_{Th}q_0m}{F}-\frac{k_{Th}C_0}{F}V$$

Where,

C_0 is the initial concentration of influent (mg/lit), C is concentration at given time t (mg/lit), k_{Th} is the

Thomas rate constant (ml/(min)(mg)), m is the mass of adsorbent in the bed (g), F is flow rate of the influent (ml/min), q_o is maximum adsorptive capacity of the bed (mg dye/g of adsorbent), V is the cumulative throughput volume (litres)

Thus, a plot of $\ln\left(\frac{C_0}{C}-1\right)$ vs V gives a straight line of slope $-\frac{k_{Th}C_0}{F}$ and an intercept of $\frac{k_{Th}q_0m}{F}$

These values are used to evaluate the Thomas model parameters k_{Th} and $q_{o..}$

Table 1 gives the values of Thomas Model parameters and R^2

Table I. Thomas Model Parameters and R^2 Values.

Ini.conc (mg/l)	Flow rate (l/h)	Bed Ht. (cm)	k_{Th}(ml/min-mg)	q_0 (mg/g)	R^2
200	1	15	0.00862	233.32	0.94
300	1	15	0.00727	259.35	0.97
300	0.5	15	0.00359	279.93	0.93
200	1	7.5	0.0158	88.67	0.95
200	1	12	0.01303	226.99	0.96

Linear regression was applied to fit the straight line that best represented the data. Fig.4 shows the best fit of this method.

Thomas model parameters were found to be k_{Th}=7.27 x10^{-3} ml/min-mg and q_0=259.35mg/g with R^2=0.97.

The results of Linear Regression for various other runs are shown in Fig. 5 and Fig. 6.

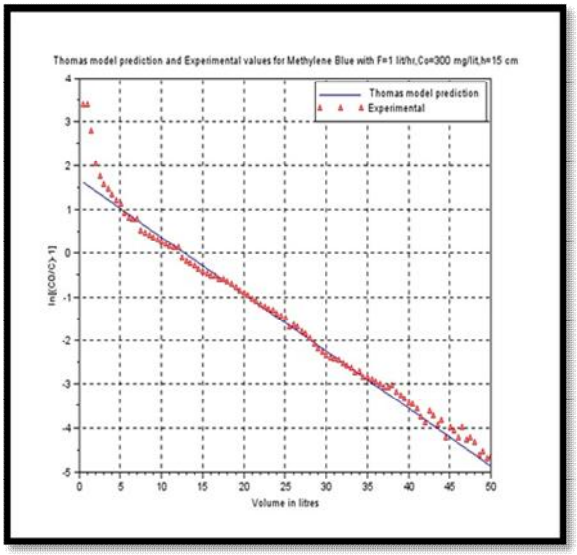

Fig.4. Thomas model prediction and Experimental values with F=1 lit/hr, C_0=300mg/lit, column height=15cm

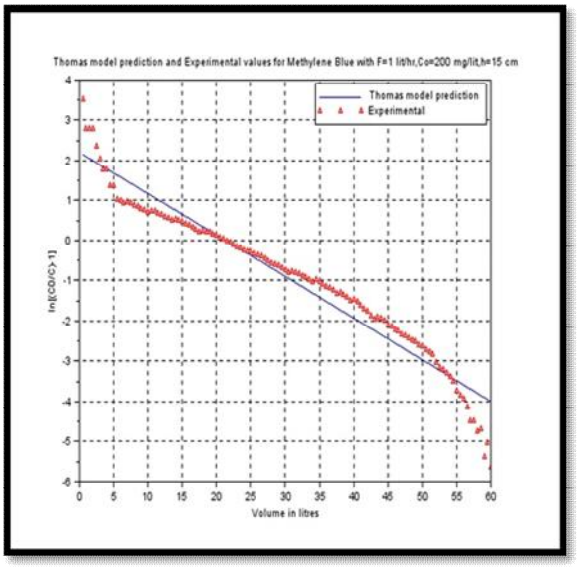

Fig.5. Thomas Model Prediction and Experimental Values.

B .Application of Bed Depth Service Time (BDST) model

A linear relationship between bed depth and service time is given by the following equation:

$$t = \frac{q_m H}{C_0 u} - \frac{1}{k_B C_0} \ln\left(\frac{C_0}{Cb} - 1\right)$$

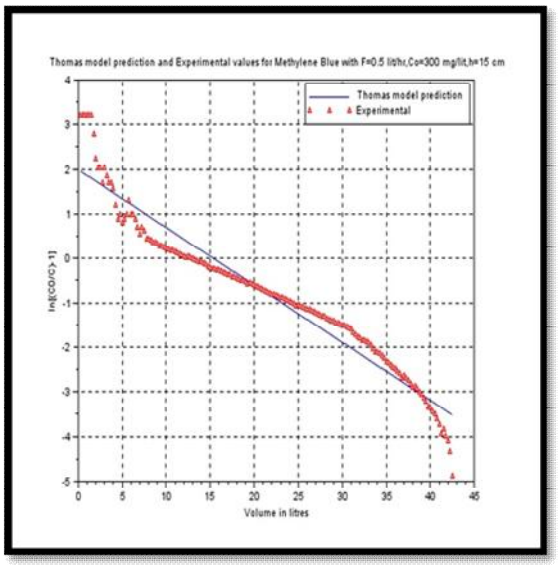

Fig.6. Thomas Model Prediction and Experimental Values.

Where, t is breakthrough or service time (min),q_m is adsorption capacity (mg/lit), H is bed height (cm), C_0 is influent concentration (mg/lit), Cb is breakthrough concentration (mg/lit), u is linear velocity through the column (cm/min) {Linear Velocity = (Volumetric Flow Rate)/ ((Cross-sectional Area of the bed)*(Porosity))} and k_B is BDST rate constant (lit/(min)(mg))[4].

The experimental results obtained in test runs 1, 4 and 5 given in Table 1. were fitted to the BDST model.

The bed height in the test runs were varied keeping the concentration and flow rate constant at 200 mg/lit and 1 lit/hr respectively. Linear regression was used to fit the model using bed heights 7.5, 12 and 15 cm shown in Fig. 7. The model parameters were found to be k_B=0.1906 ml/min-mg and q_m= 49.507 mg/lit with R^2= 0.972. R^2 is a statistical parameter which shows how best the straight line fits in the data. These models can be used for a wide range of Methylene Blue concentrations in solution. A higher concentration would require a

longer bed of adsorbent to achieve the same break through point.

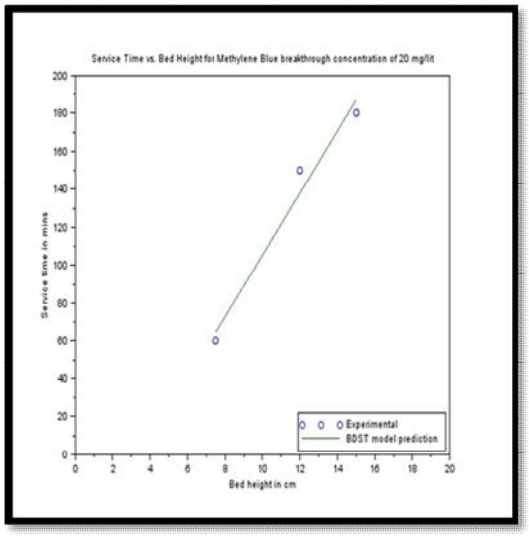

Fig.7. Service time vs Bed depth at bed heights of 7.5cm, 12 cm and 15 cm. Column diameter=2.5 cm

C. Comparison of Thomas Model and BDST Model

If the same L/D of the column and the linear velocity is maintained in the small scale and full scale operation, both the models can be used fairly accurately and could be used for a quick scale up of the process. When these conditions differ greatly, the applicability of these models reduces.

The Thomas model is applied to estimate adsorptive capacity of adsorbent and predict breakthrough curves, assuming second order reversible kinetics, no axial dispersion and the Langmuir isotherm. Theoretically, it is suitable to estimate the adsorption process where external and internal diffusion resistances are extremely small.

The BDST model assumes that the rate of adsorption is controlled by the surface reaction between the adsorbate and the unused capacity of the solid. The BDST model gives a linear relationship between time required to reach the desired breakthrough concentration (C_b) and the bed depth (H). Though the model is not applicable beyond C/C_0=0.5,it is fairly accurate in describing breakthrough behavior in the initial stages of the process.

D. Disposal of Used Bagasse

The exhausted bagasse can be used for landfilling, incineration or fillers for building materials. Research is underway for the biodegradation of these used bagasse using certain strains of bacteria.

E. Cost Analysis

Sulphuric acid treated sugarcane bagasse has been proved to be an effective and cheap adsorbent for removal of dyes from textile effluents (especially the wash solution after dyeing stage). It has the potential to be an efficient low-cost alternative to the much expensive activated carbon for small-scale textile plants in India. The cost of sugarcane bagasse is around Rs. 60 / tonne and considering the cost of transport, chemicals and electrical energy used in the process, the price of the finished product is estimated to be around Rs. 400 / tonne of adsorbent. The freight charges are not that substantial considering the fact that most small-scale textile units are concentrated in those states where sugar industries are located, namely Uttar Pradesh, Tamil Nadu, Maharashtra, Karnataka etc. Cost of chemicals is again not very high since the only materials needed for adsorbent preparation are 98% sulphuric acid and sodium bicarbonate. The largest contributor to the cost of adsorbent is thus electricity.

The adsorption capacity of treated sugarcane bagasse is found to be 51.867 mg/g, whereas the traditional charcoal activated carbon adsorbent have reported an adsorption capacity of 131.8 mg/g [5].The price of the cheapest available commercial activated carbon is Rs. 17000 / tonne.

So this treated sugarcane bagasse is a good replacement of the activated carbon adsorbent.

IV. CONCLUSIONS

Treated bagasse adsorbent is considerably cheaper than activated carbon, thus it is a competitive low cost alternative. Batch studies confirmed that Methylene Blue dye has considerable affinity for bagasse and hence it can be used for effective removal of this dye from dye-laden wastewater. Column studies demonstrated a good fit of Methylene Blue experimental data into the BDST model and Thomas model. The model parameters thus obtained can then be used to scale up the column from lab to pilot scale.

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How Secure is your NFC

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***Abstract*—This paper addresses a set of threats and possible counter measures against NFC security issues. New users of near field communication, especially for payment purposes such as storing credit card information, are understandably concerned at first about the security and safety of their private information. Possible security attacks include eavesdropping, data corruption or modification, interception attacks, and physical thefts. Below we cover the risks and how NFC technology works to prevent such security breaches from occurring.**

***Keywords*— NFC; Security**

I. INTRODUCTION

NFC, short for Near-field (or Nearfield) communication (NFC) is a kind of wireless communication with a maximum communication range of less than 20 centimeters. Wide acceptance of online payment system has been driving the evolution of NFC technologies in recent years. Even though the security issues of NFC are a matter of concern, NFC technology is widely accepted by a large mass. Emergence and huge investment in e –commerce and e-marketing have posed new challenges for developing high performance and highly secure NFC infrastructure. The major challenge in NFC is to give its customers a easier, more convenient or better and secure NFC client-server interaction without performance degradation.

In this paper we introduce various known and possible NFC security issues. The paper is organized as follows. Section 2 describes the overview of NFC and its security issues. Section 3 describes probable solutions for security issues mentioned in section 2 to increase the performance and scalable implementation of NFC based on objective tests. Finally section 4 concludes the paper.

II. NFC AND ITS SECURITY ISSUES

A. What is NFC?

NFC stands for "Near Field Communication" and, as the name implies, it enables short range communication between compatible devices. This requires at least one transmitting device, and one receiving device to receive the signal. A range of devices can use the NFC standard and can be considered either passive or active, depending on the device working principle.

Passive NFC devices include tags, and other small transmitters, that can send information to other NFC devices without the need for a power source of their own [3]. However, they don't really process any information sent from other sources, and can't connect to other passive components. These often take the form of interactive signs on walls or advertisements.

Active devices are able to both send and receive data, and can communicate with each other as well as with the passive devices. Smart phones are by far the most common implementation of active NFC devices, but public transport card readers and touch payment terminals are also good examples of the technology.

Just like Bluetooth and Wi-Fi, and all manner of other wireless signals, NFC works on the principle of sending information over radio waves. Near Field Communication is another standard for wireless data transmission, meaning that there are specifications which devices have to adhere to, in order to communicate with each other properly. The technology used in NFC is based on older RFID (Radio-frequency identification) ideas, which uses electromagnetic induction in order to transmit information [4].

This marks the one major difference between NFC and Bluetooth/Wi-Fi, as it can be used to induce electric currents within passive components so as to either receive or send data. This means that passive devices don't require their own power supply, and can instead be powered by the electromagnetic field produced by an active NFC component when it comes into range, but we'll talk about that in greater detail some other time. Unfortunately, NFC technology does not command enough inductance to be used to charge our smart phones, but QI charging is based on the same principle.

The transmission frequency for data across NFC is 13.56 megahertz, and data can be sent at 106, 212 or 424 kilobits per second, which is quick enough for a range of data transfers – from contact details to swapping pictures and music.

In order to determine what sort of information is to be exchanged between devices, the NFC standard currently has three distinct modes of operation for compliant devices. Perhaps the most common use in smart phones is the peer-to-peer mode, which allows two NFC-enabled devices to exchange various pieces of information between each other. In this mode both devices switch between active, when sending data, and passive states when receiving.

Read/write mode, on the other hand, is a one way data transmission, where the active device, possibly your Smartphone, links up with another device in order to read

information from it. This is the mode used when you interact with an NFC advert tag.

The third mode of operation is card emulation, wherein the NFC device can be used like a smart card or contactless credit card in order to make payments or tap into public transport systems.

B. NFC Hardware Architecture

Major components of NFC hardware are Host-Controller, Secure Element, NFC-Controller and NFC-Antenna [2]. A description of the NFC related elements in mobile devices is depicted in the Figure 2.1

1. The Host-Controller: It is the Application Execution environment (AEE), where the application rests, which controls NFC. It is mostly a mobile device or smart car key

2. The Secure Element: Trusted Execution Environment (TEE), the secure environment where sensitive information such as debit card data is stored, stored within the host controller. For communication with secure element, smart care interface, NFC wired interface or single wire protocol is commonly used. Since it needs to store sensitive data and that needs to be encrypted, there must be functions to execute security relevant software [6]. This can be achieved with cryptographic functions or with changeable hardware like secure memory card.

3. The NFC-Controller: It is link between host and NFC, with an interface to secure element. This acts as modem between analog air interface (The radio frequency medium) and other digital interfaces.

4. NFC-Antenna: simply put this is simply loops of wire, occupying as much surface area as the device allows.

C. Who can use NFC?

NFC is an interface used for variety of applications today. Here, we explain three different applications, which use NFC. These examples give text case environments for the security aspects of NFC explained in coming sections.

- Contactless Token: RFID label, contactless smart cards etc are examples of applications that use NFC to retrieve data from passive token. Data may be stored in some device, so that it may be conveniently read by any person having NFC device. An example of such data is the promo video of the movie stored in electronic poster. NFC user may go to its proximity to get the short video to download it to their mobile phone. Another example is getting the Wi-Fi configuration data, URL etc to access to the correct webpage or network. Here, the tokens are physically included into a device without any electronic connection to that device. But only interface of the token is contactless. Token usually have minimal computing power, so it cannot run any complex protocol.

- Ticketing / Micro Payment: Here, ticket or e-cash is stored in some secure device like smart card, mobile phone etc. when one needs to do some business, he/she has to go to the proximity of the collector machine to debit the payment. A two phase interface is commonly used for this kind of payments. First interface will do initial handshakes for establishing the connection. Second interface usually linked to the mobile phone CPU, used for verifying balance or purchasing ticket through root network of mobile phone. This type of application needs 'secure NFC' in order to establish secure authentication using external security measures.

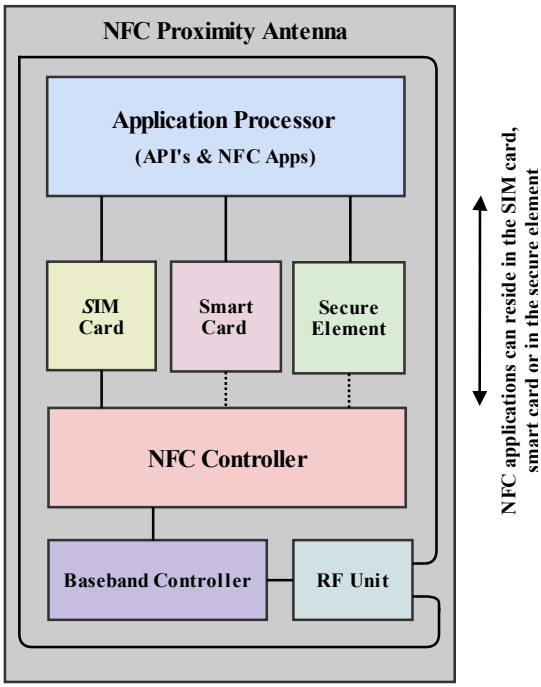

Fig. 1. A description of the NFC related elements in mobile devices

- Device Pairing: Imagine a situation where Bluetooth connection needs to be established between a laptop and projector. It creates a burden to establish a Bluetooth link between devices by going through so many configuration steps, like navigating through menu, selecting right device, passing security token and authenticated connection etc. Using NFC, Bluetooth link may rightly established by bringing the device close together and running a preconfigured protocol.

D. Who benefits from near field communication?

- Busy moms checking out at the grocery store
- Businessmen and women riding the subway to work
- Businesses looking for faster, more secure payment methods for customers
- Students touring a museum and
- many more

III. Security Issues of NFC

A. Eavesdropping

Eavesdropping is a major concern in NFC communication. NFC uses radio frequency waves for communication. The communication signal passing between NFC devices may also be received by a third party (may be an attacker) directly or using some antenna. We oversee attacker be using advance tactics to extract information from the received signal.

Since the equipment for NFC is widely available, it also assumed that, devices are available for the attacker in order to receive the NFC signal as well as to decode it. Literally no extra high end special circuitry is required to do this task. Mostly NFC communication wills happen between devices at most a distance of 10 meters. This makes an intender attacker also to be in this proximity in order to do an attack. In usual cases, this requirement gives an extra virtual security against various attacks to NFC. We may say that NFC gives security because of its following characteristics

Frequency range of communication should be known by exploiter. Since the proximity of communication is certain to a maximum of 10 meters, the clarity of the data received in the attackers' receiver will be inferior. Unless the attacker uses very sophisticated decoder, the clarity of the decoding will be impossible. The feature of attacker's antenna is also a matter of concern, especially for the parameters like its reception capacity, its geometry, its capability to change position etc.

Radio frequency factors of the sender also matter, especially for the senders' sending capacity, its PCB, atmosphere it sends data etc. Therefore, an attacker's infrastructural environment will be suitable only for a certain intended pair of sender and receiver, but not for a general NFC infrastructure. Since NFC commonly used for personal infrastructure, it does not induce a general security concern.

Another important fact is whether the NFC is working in active mode or passive mode. That is whether sender generates its own radio frequency field or it utilizes the radio frequency of another. In active mode, the sender and receiver generates its own RF field for length of 10metrs. In passive mode, the sender utilizes the RF field of receiver for communication (or vice versa sometimes) for a distance of 1 meter. In passive mode, eavesdropping is very difficult. Since even the sender itself uses the RF filed generated by the receiver, the eavesdropping can be tried to limit of maximum 1 meter. In this range eavesdropping is practically impossible.

B. Data Corruption

This is one kind of denial of service attack. Here the attacker will distract the communication by modifying the data sent from the sender to receiver. Here the attacker finds the modulation scheme and coding of the sender first. At least tries to predict these values. Then attacker will transmit some irrelevant data at the corresponding frequency by which sender is also sending and at the same time. By this the attacker's intention only is that, the receiver shall not understand the actual data send by the sender, since the data is already spoilt due to cross talk.

C. Data Modification

This is otherwise called as alteration attack. Here, attacker tries to attack the integrity of the transmitted data by unauthenticated alteration. The receiver thinks that he got the valid data, but in fact the data has got manipulated. This kind of attack is possible only when the sender, eavesdrop the strength of the amplitude modulation. NFC uses two types of communication- 100% modulation with modified miller coding or Manchester coding and 10% modulation with Manchester coding. Different modulation standards used in NFC communication is depicted in Fig.2.

In 100% modulation the two half bits of communication signal represents either 1(ON) or 0(OFF). In 100% modulation, the attacker may fill an OFF with the carrier frequency. Then he must generate an OFF, which is received by the actual receiver. That means, the sender tries to send some signal with an intention to overlap with the original signal so that the receiver receive a zero signal. But this is impossible. But in modified miller method, the two consecutive 1's {11}, the attacker may change second to zero. But changing 0 to 1 is not possible. Modulation depends on baud rate. From figure 2.2, we know that baud rate greater than 106 uses 10% modulation. Where OFF is not zero, but it is about 82% of the level of non OFF (ON) signal. Otherwise, signal is either 82% or full in actual situation. So, the attacker adds some signal to 82% signals to make it full and drop some from full to make it 82%. So a bit 1 will be decoded as 0 and 0 to 1. So, in 10% ASK, with Manchester encoding, this kind of attack is possible.

Data rate (kbps)	Active Device	Passive Device
106	Modified Miller, 100%, ASK	Manchester, 10%, ASK
212	Manchester, 10%, ASK	Manchester, 10%, ASK
424	Manchester, 10%, ASK	Manchester, 10%, ASK

Fig. 2. NFC signal modulation standards

D. Data Insertion

Here, the attacker either inserts a new message or replaces the actual message while data exchange is happening between NFC devices. This scenario is valid only when the receiver requires more time for producing reply. The attacker give reply before the actual party replies; and the sender assumes that, this is the actual reply message got from the receiver.

E. Man-in-the-Middle-Attack

The classical man in the middle attack is in such a way that, the message between real communication parties Alice and Bob is being diverted through a third party attacker, Eve. Alice and Bob may not aware that, they are not actually talking each other, but they are actually sending and receiving

from Eve. This a kind of compromised key attack usually used for unauthenticated access to certain protocols. After getting access to the key for communication between Alice and Bob to Eve (now the key is called compromised key), Eve uses this key to send and receive data from both Alice and Bob. It may happen that, Eve uses different keys for communicating Alice and Bob. Eve communicates to Alice and Bob, but Alice and Bob thinks that, they are communicating each other. Eve, having the key may also eavesdrop and manipulate it. But, how is it possible in NFC? Remember, the NFC in passive mode gives extra security against this attack. Consider the sender (Alice) is in active mode and receiver (Bob) is in passive mode. What Eve tries to do is to receive from Alice as well as to disturb Bob from receiving data. But this can be easily understood by A that, Bob is not receiving data, because the communication protocol will be mostly reliable. Once Alice finds something messy, Alice stops key exchange to Bob. When Alice does not monitor this unsafe situation, since is in passive mode, still we are in safe situation. Assume Eve receives message, and it tries to send a different message to Bob. Now, Eve needs to make different Radio frequency field to make the message to pass to Bob. Remember, Radio frequency field generated by Alice still exists. Ultimately two RF fields will be active at the same time. So, it will be impossible to Bob, to understand the data send by Eve. So, man in the middle attack in this environment is not possible.

Second possibility is the environment where Alice is in active mode and Bob is in active mode too. Alice sends data to Bob and this is received by Eve, because of its close proximity to Bob. Now, Eve disturbs the message to Bob, by disturbing the signal. As this can be easily monitored by Alice and can stop the key exchange. Now, if Alice is not monitoring this unsafe situation, Eve needs to send data to Bob; but once sending is over from Alice, Alice will go to receive mode to receive reply from Bob. At this point both Alice and Bob are in receive mode. Now, the radio frequency generated by Eve will be received by both Alice and Bob, and Alice can detect it as unusual, and can stop the key exchange. So, both in active and passive mode of NFC, man in the middle attack is not possible.

F. NFC Message Spoofing

The NFC Data Exchange Format (NDEF) defines a message exchange format for information exchange. An NDEF may contain one or more NDEF record. NDEF record contains header and payload. General NDEF header format is depicted in Fig.3.

Any internal structure of the data carried within the payload field is opaque to NDEF [1]. Implementers should pay special attention to the security implementation of the record types that can cause remote execution of any action in the recipient's environment. Before accepting record of any type, an application should aware of the particular security implication associated with that type. An attacker may use program to make packets contain malicious or modified information that hurt the receiver.

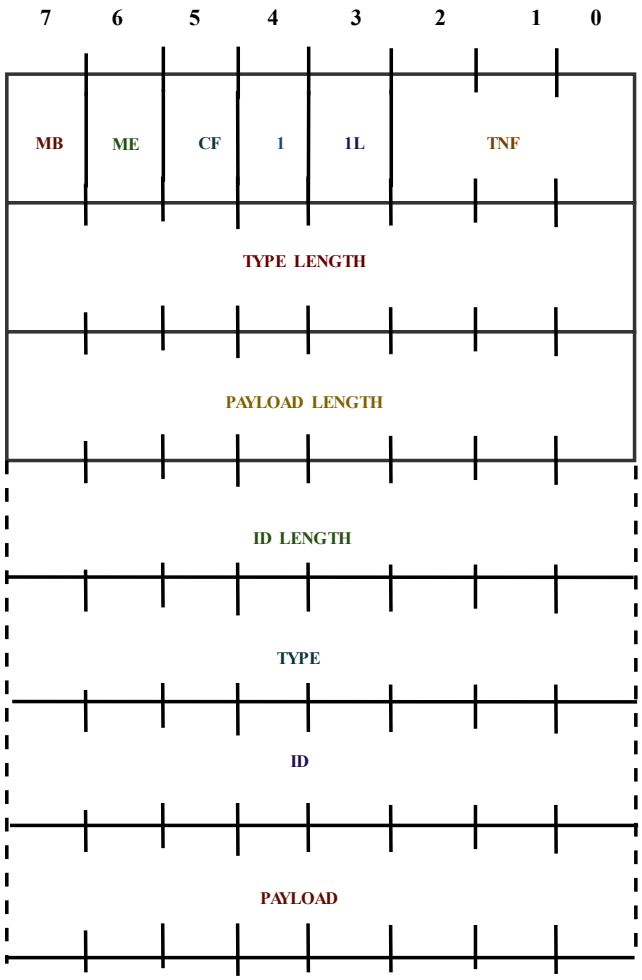

Fig. 3. NDEF header with Short Record (SR) value 1

IV. SOLUTIONS FOR NFC SECURITY ISSUES

A. Establish Secure Channel for NFC

One of the classical solutions for network communication security problems like Eavesdropping, Data Modification, Data Insertion, Message Spoofing etc is to establish a secure channel between the communicating devices. From section 2.4.5 we came to know that, the 10 meter communication limit gives an inherent protection against man in the middle attack for NFC. So, a standard unauthenticated version of Diffie-Hellman key exchange protocol may be used to exchange a secret key between NFC devices [7]. This key may be used to device a symmetric key using algorithms like AES, DES etc. This key will be used for establishing secure communication channel for data exchange in NFC for both active and passive modes.

B. A key exchange protocol specific for NFC

The processing capacity of the NFC hardware will be usually limited. Making a symmetric key as discussed in the previous section for standard devices, increases computational

requirements significantly. Thus, another solution with low computation is, to make a key exchange protocol specific for NFC. Before communication between parties, constitute an agreement for the timing of the bits, phase and amplitude of the radio frequency signal. Here, the communicating devices, at the same time, send the data to each other. We know that a device can send and receive at the same time, as it uses separate hardware and buffers for sending and receiving data.

Now, let us see all four combinations of communication;

Situation 1: Both A and B sends '1'

Situation 2: Both A and B sends '0'

Situation 3: A sends '1' and B sends '0' and

Situation 4: A send '0' and B sends '1'

In situation 1, the resultant signal will be '1'; and an attacker seeing the sum RF signal, figure out that both devices have sent a '1'. In situation 2, resultant signal will be '0' and an attacker also sees this '0'. But, these results seen by the attacker in situation 1 and 2 will not help him much. Let us see the situation 3, where attacker sees the result '1'. A knows what he send is '1' and understand that, what he received might be a '0'. At the same time, B gets result 1 and knows what he has sent. So it accepts a '1' as received data from A. Let us see what happens with the attacker, he sees result '1', but could not able to distinguish who sends a '1' and who sends a '0'.

Bur this scheme of security helps us only when 100% ASK being used. Now, the device collects all bits when the two devices sent different values. This way A and B can agree on shared secret key. Remember, if the attacker can someway understand and distinguish data from A and B, this protocol fails. So, the data should be sent at the agreed upon amplitude and phase.

C. *Protection against Eavesdropping*

Protection against eavesdropping for NFC in active mode is hard to achieve. But in passive mode, it is difficult to eavesdrop. A solution for eavesdropping is to make a secure channel between devices before actual communication. We have seen the details of establishing a secure communication channel in the section IV.A

D. *Protection against Data Corruption*

Usually for data corruption, an attacker uses high power radio frequency signal in the channel, so that the receiver won't get the correct data. This high power disturbance may be easily detected by the sender, because of it lesser communication perimeter of length 10 meters. So, effective counter measure can be taken easily.

E. *Protection against Data Modification*

By using 106k Baud in active mode it gets impossible for an attacker to modify all the data transmitted via the RF link as described in section 2.4.3. But for both directions active mode should be there to protect against data modification. But this kind of set up is vulnerable to eavesdropping. Usually NFC devices continuously monitor the radio frequency field for probable disturbances. If there is occurrence of any possible data modification activity, the sender will stop transmission.

Another solution would be a secure channel as described in section IV.A

F. *Data Insertion*

A best solution for Data Insertion is establishing a secure channel as described in section IV.A.

There are certainly, other possible countermeasures. The first one is, both A and B should respond immediately. So, the attacker cannot take decision for data insertion. Another solution is, listening by the receiving device to the channel during the time, it is open and at the starting point of the transmission. The device could then detect an attacker, who wants to insert data.

G. *Man-in-the-Middle-Attack*

We have already seen in section II.B, that man in middle attack is not possible in NFC.

V. CONCLUSION

We have addressed a set of threats and possible counter measures against NFC security issues. Man in the middle attack is generally not possible in NFC, both in active and passive modes. This helps us to establish secure NFC channel through simple key exchange protocol before actual NFC data communication. Other issues like data modification, data insertion, message spoofing etc can be solved using a secure NFC channel. NFC specific key exchange protocol may also be implemented for establishing secure NFC channel with limited computational overhead.

Even though security issues of communication standards are addressed and solved, many other issues are still not found and require to be found to be solved. In this scenario NFC is not different. Thus we would like to give away the question once again to the readers- "How secure is your NFC?"

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Simulation of Vanilla call option with non-zero dividends using Operator Splitting Method

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***Abstract*—In this study, we perform a numerical computation of two dimensional Black-Scholes equation vanilla call option with non-zero dividend values. Operator-Splitting method is employed to obtain the results. The validity of the Operator Splitting Method (OSM) is done using studies in previous literature. Plots and necessary discussions has been carried out to describe the obtained results**

Keywords—Two-dimensional Black-Scholes equation, Operator Splitting method; Vanilla Call option (key words)

I. INTRODUCTION

In Mathematical Finance, Black-Scholes partial differential equation have been studied extensively. The equations were first discovered by Black and Scholes [1]. Since its discovery, it has been studied by many researchers. The equations assume the existence of perfect capital markets and security prices to be log normally distributed [2]. The equation has been modified by many investigators. The equation has been modified by introducing incomplete market, illiquid, transaction cost Arenas, González-Parra and Caraballo [3]. Transaction cost models of nonlinear Black-Scholes equations with non-constant volatility has been studied by Ankudinova and Ehrhardt [4] numerically. Numerical methods or partial numerical methods are also used to study the modified Black-Scholes equations by Ahn, Kang and Kwon [9], Tagliani and Milev [8], Zhongdi and Le [7], Company, Jódar, Pintos, and Roselló [6], Lesmana and Wang [5] to name a few.

In the present article we study the effect of non-zero dividends applied to two-dimensional Black-Scholes option pricing models using Operator Splitting Methods (OSM). The model is adopted from Jeong and Kim [10].

II. EQUATIONS

The two-dimensional Black-Scholes equation with dividend, d, along with the initial conditions are given by [10],

$$\frac{\partial u}{\partial t} = \frac{1}{2}\sigma_1^2 x^2 \frac{\partial^2 u}{\partial x^2} + \frac{1}{2}\sigma_2^2 y^2 \frac{\partial^2 u}{\partial y^2} + \rho\sigma_1\sigma_2 xy \frac{\partial^2 u}{\partial x \partial y} + rx\frac{\partial u}{\partial x} + ry\frac{\partial u}{\partial y} - ru \tag{1}$$

along with initial and boundary conditions,

$$\Lambda(x, y) = \max\{x - X, y - X, 0\} \tag{2}$$

III. NUMERICAL SOLUTION

In order to obtain the results for Eq. (1) along with the terminal condition Eq. (2) is solved using the Operator Splitting Method [10, 11]. The computations where carried out for r-d = 0.03-0.01, 0.03-0.02, 0.03-0.0, 1.0-0.01, 1.0-0.2, 1.0-0.0.

Computed result and the plot for the case r-d= 0.03 – 0.0=0.03 (Fig. (6) – (7)) where compared to the figure plotted in [10] (Fig. (10)). The figures are in excellent agreement. Hence, proving the results obtained are authentic and its extension to other values of parametric values are valid.

IV. CONCLUSIONS

In this article results of Vanilla call option with non-zero dividends using Operator Splitting Method has been carried out. The article highlights the use of operator splitting method as a numerical technique in the field of Mathematical Finance. The importance of OSM has been proved by many investigators as powerful technique in solving Black-Scholes partial differential equation. The present investigation is also a attempt in that direction. The OSM can be extended further to three or more dimensional Black-Scholes partial differential equations. This will be one among the future extension of the present investigation.

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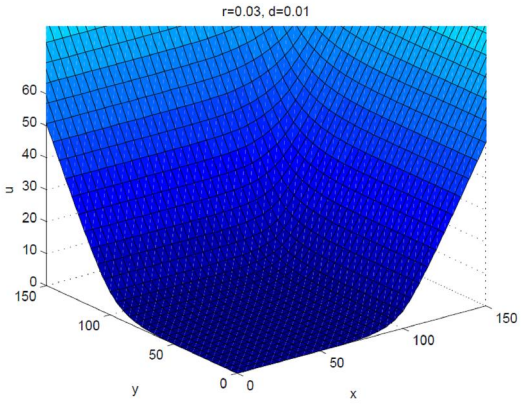


Fig. (1) Solution at $u^{1/2}$

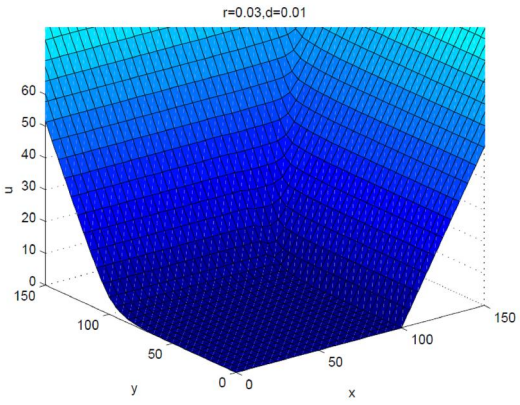
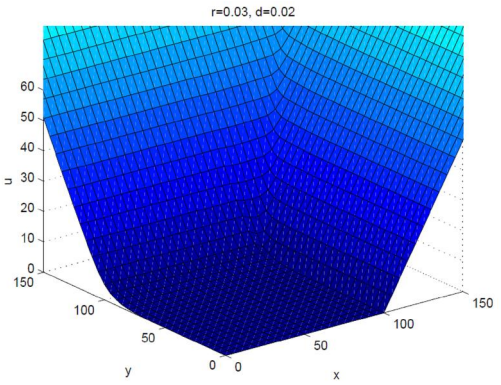


Fig. (2) Solution at u^{1}



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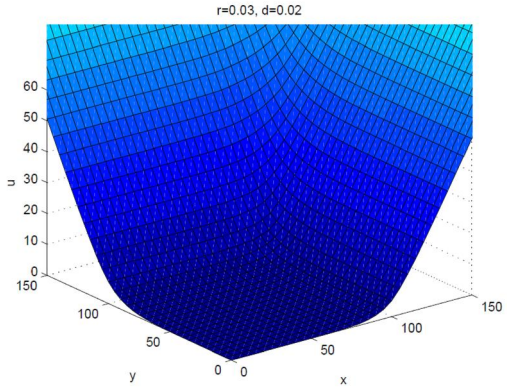
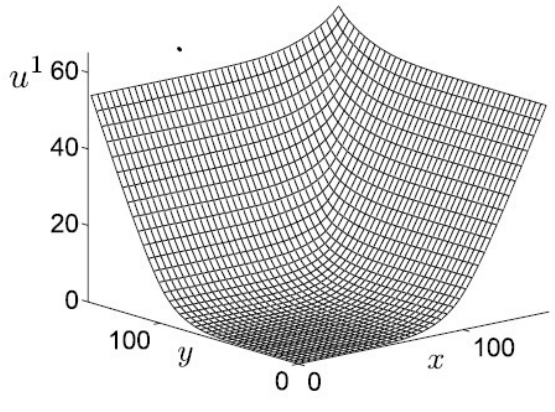


Fig. (4) Solution at u^{1}



OSM

Fig. (5) Solution as obtained by [10]

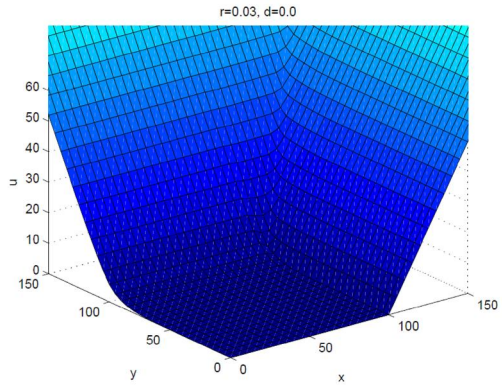


Fig. (6) Solution at $u^{1/2}$

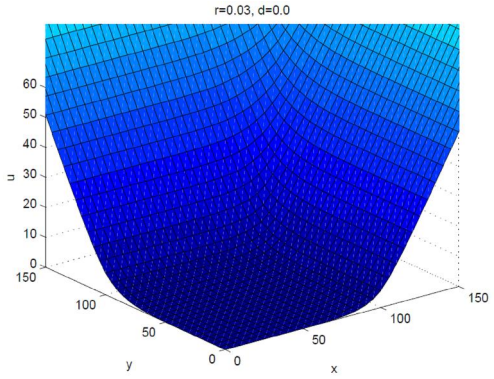


Fig. (7) Solution at u^1

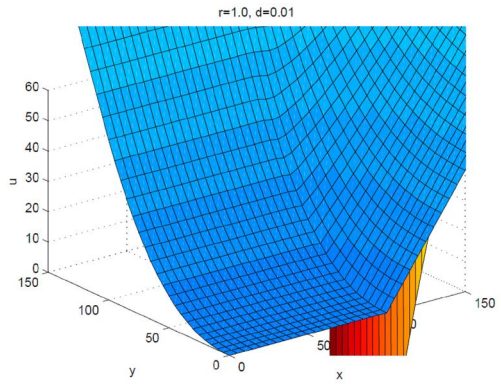


Fig. (8) Solution at $u^{1/2}$

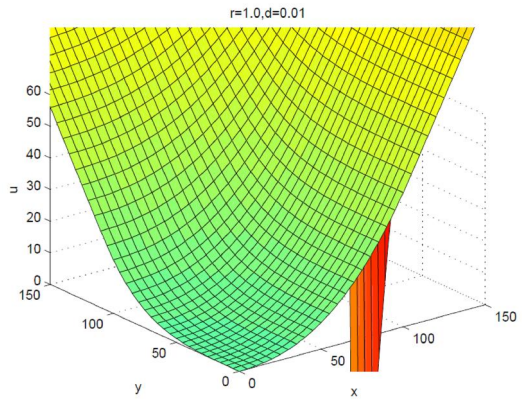


Fig. (9) Solution at u^1

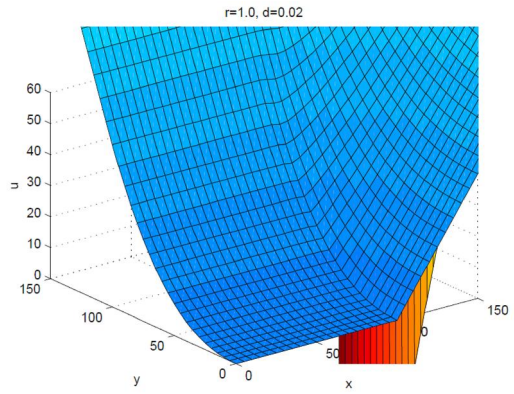


Fig. (10) Solution at $u^{1/2}$

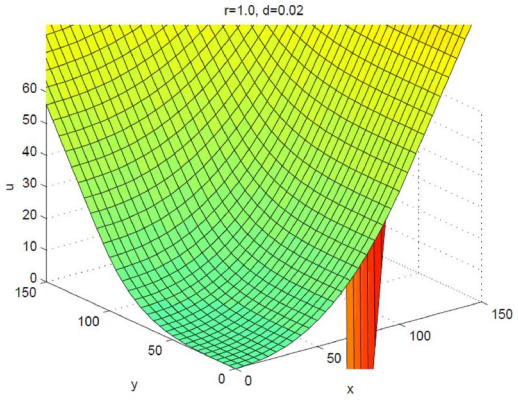


Fig. (11) Solution at u^{1}

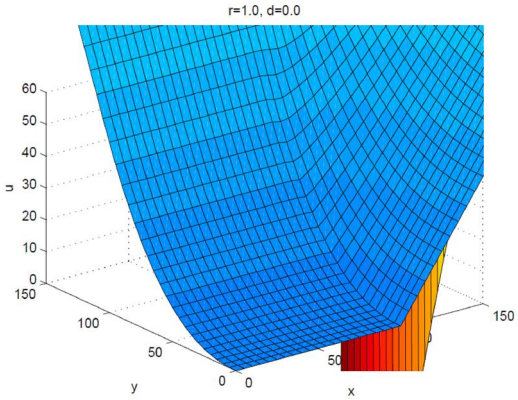


Fig. (12) Solution at $u^{1/2}$

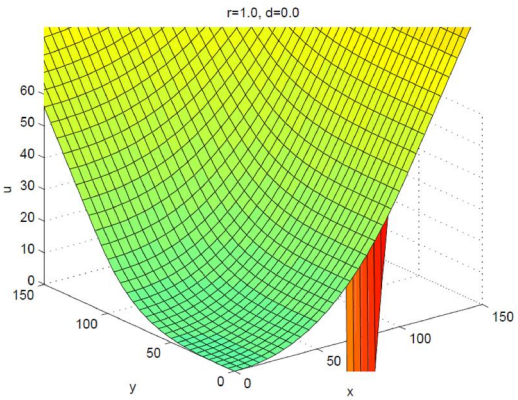


Fig. (13) Solution at $u^{1/2}$

Studies on drying of loose marigold flowers in comparison with dried helichrysum, chrysanthemum and gerbera flowers under West Bengal condition

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Abstract

This study was conducted in the laboratory of Post harvest Technology of Horticultural Crops, Bidhan Chandra Krishi Vishwavidyalaya, Nadia, West Bengal, India. The experiment was laid out in factorial CRD with two varieties of African marigold (Bidhan 1 and Bidhan 3), five varieties of chrysanthemum (BC 5; BC 16; BC 41; BC 31; BC 45), two varieties of gerbera (Elegant and Calcutta pink) and five varieties of helichrysum (Yellow; Deep pink; Light pink; Orange; White). The drying was undertaken with two different medias (sand and silica gel), which was replicated thrice with ten number of flower heads in each replication. Results showed that *Helichrysum* was the best performer in all aspects of quantitative and qualitative features of drying, followed by gerbera, chrysanthemum and marigold. Colours of the flowers were shown to have an impact on drying and storage however, yellow colour flower was more or less same. Embedding in silica gel was found to be the best method of drying in all cases. Storage life for Bidhan 1 and Bidhan 3 varieties of marigold was only for 19 and 21 months when dried by silica gel embedding. Therefore, even though dried marigold flowers could not reached the criteria of dry *Helichrysum* flower acceptable quality attributes along with longer storage life was observed when silica gel was used as embedding media in hot air oven drying.

Keywords: silica gel, marigold, helichrysum, drying

Introduction

The demand for dry flowers and attractive plant parts, dried floral arrangements and floral crafts has increased manifold during the last decade [20] (Singh 2009). Dry flowers score over cut flowers because of their ability to remain decorative for longer periods with less care [23] (Zizzo and Foscella, 1999). Drying of flowers and foliage by various methods like air drying, sun drying, oven and microwave oven drying, freeze drying and embedded drying can be used for making decorative floral crafts items like cards, floral segments, wall hangings, landscapes, calendars, potpourris etc. for various purposes [3,1] (Bhutani, 1990; Bhalla and Sharma, 2002) with potpourris being the major segment of drying flower industry valuing at Rs 55 crore in India alone [12] (Murugan *et al.,* 2007). Marigold petals are lucrative source of bio-dyes, essential oils and other bio-control ingredients. Further these are used commercially for making *rangolis* in festive seasons and as chicken feed to improve the yolk colour [10] (Hasin *et al.,* 2006). Thus drying of marigold flowers *vis a vis* marigold petals could be an effective tool to increase the usefulness for a longer time in many commercial aspects as stated earlier.

Materials and Methods

The experiment was undertaken immediately after harvest where good quality flowers with uniform stem thickness were selected for the experiment and trimmed to uniform length. Flowers were checked again in the laboratory for any possible mechanical injury in the flower head. Flower stalks were trimmed to 5cm length and were immediately used for treatment. The harvested and uniformly trimmed flowers were embedded in well dried, fine quality white river bed sand and fine powdered silica gel (white colour) in plastic trays of uniform size (41×30×6 cm). After embedding the flowers, the containers

were kept in electrically operated hot air oven at a controlled temperature of 45^0 C. Two varieties of African marigold (Bidhan 1 and Bidhan 3), five varieties of chrysanthemum (BC 5; BC 16; BC 41; BC 31; BC 45), two varieties of gerbera (Elegant and Calcutta pink) and five varieties of helichrysum (Yellow; Deep pink; Light pink; Orange; White) were taken for qualitative discussion of marigold with respect to other ornamentals like *Chrysanthemum, Gerbera and Helichrysum* flowers. Therefore, a comparative study was made during the year 2011-12 and again repeated for the year 2012-13 at Laboratory of Post harvest Technology of Horticultural Crops, Bidhan Chandra Krishi Vishwavidyalaya, Nadia, West Bengal, India. Statistical analysis of the data recorded was done by factorial CRD which was replicated thrice with ten numbers of flower heads in each replication.

Results and Discussion

Helichrysum was the best performer in all aspects of quantitative and qualitative features of drying, followed by gerbera, chrysanthemum and marigold. Maximum loss in weight and dry matter content with minimum moisture and least drying time (Table 1) were observed in *Helichrysum* yellow and deep pink flowers. Lowest moisture loss in *Helichrysum* flower is due to low initial moisture level and hard petals [17] (Sangama, 2004). Bhutani [4] also reported that embedding in silica gel was perhaps the easiest and the best method of embedded drying of flowers. Trinklein [22] reported that since silica gel could dry flowers quickly, thus more flowers could be moved in and out of the mixture during a single season.

Darker shade of flower colour had changed to lighter shade in all the cases (Plate 1). White flower also change to slightly off-white which were prominent in sand drying. However, yellow colour flower was more or less same. There was no disc shredding of *Helichrysum* flowers in our observations which might be due to partially open stage of flowers at harvest. Since disc reflex downward and centre disc florets shedding are some major defects if flowers are not harvested at proper stage.

Maximum score for brittleness as well as lowest moisture content was exhibited by *Helichrysum* yellow dried by embedding in silica gel after drying and even after storage for 6 months and 9 months (Table 1 and 2). This might be due to the reason that stronger and stiffer flower petals in dried flowers having low moisture content were observed after storage. Lower moisture content provided rigidity and uniform cell contractions in the flower while at higher moisture content in dry flowers appear flaccid.

Embedding in silica gel was found to be the best method of drying in all cases. Since embedding in silica gel prevents the direct removal of moisture from flowers by acting as an intermediate which prevents shrinkage of the flowers, degradation of colouring pigments, also provided mechanical support and physical pressure by the media that have influenced the mode of moisture liberation from flower tissue causing uniform drying. Also might be attributed to the hydrosorbant nature of silica gel which is manufactured from sodium silicate [9]. Silica gel is composed of a vast network of interconnecting microscopic pores, which attract and hold moisture by a phenomenon known as physical adsorption and capillary condensation. Through by this phenomenon, it acted as a dehydrating agent [15]. Pertuit [14] also reported that silica gel could absorb about 40% of its weight with water. Singh *et al.,* [20] while testing different media like sand, borax and silica gel, reported that maximum moisture loss was observed when the flowers were embedded in silica gel. Kher and Bhutani [11], while describing the properties of sand with respect to drying of flowers, said that fine sand did not react with the water vapour released during the process of drying as in the case of silica gel and borax. It allowed the water vapour to escape into the air freely thereby causing minimum loss in the moisture content. Lowest moisture loss in *Helichrysum* flower is due to low initial moisture level and hard petals [17]. Bhutani [4] also reported that embedding in

silica gel was perhaps the easiest and the best method of embedded drying of flowers. Trinklein [22] reported that since silica gel could dry flowers quickly, thus more flowers could be moved in and out of the mixture during a single season.

Champoux [6] reported silica gel as the best medium for getting excellent dried flowers that retain colour and shape. Flowers and foliage are to be embedded very carefully in various desiccants such as sand or silica gel in a suitable container during air drying to avoid shrinkage and other morphological changes [7]. Sandhu [16] described and recommended silica gel embedding as the more appropriate method for proper colour retention of helichrysum and statice. Dhatt *et al* [8] studied the methods of drying of rose buds and found that silica gel embedding of rose buds had the best quality with respect to colour and shape. The results of the present study were in harmony with the aforesaid reports, wherein silica gel by acting as drying agent could produce better quality dry flowers compared to sand used as desiccants.

Lowest storage life was recorded in Bidhan 1 variety of marigold (Table 1) when stored after sand embedded drying. However after silica gel embedded drying storage life was much longer as compared to other varieties of different flowers. Longest storage life (Table 1) was observed in M_2V_{11} i.e. silica gel embedded *Helichrysum* (yellow and deep pink) flowers where moisture content after drying and even after storage was lowest (Table 2). Moisture content in dried flowers influenced longevity. Lower moisture content showed higher longevity as also reported by Pandey *et al* [13]. A range of 8 to 11.5 % moisture in dried flowers provided optimum drying with good quality above 6 months. Also mechanical support provided by the media throughout the drying process ensures well maintained flower shape in the flowers having moisture content below 11.5%. Excessive drying of flowers resulted into petal shredding during handling. Longevity of dried flowers was observed by storing the dried flowers inside air tight desiccators without disturbances. Silica gel embedded produced flowers exhibited highest longevity. Similar results were also reported by Bhalla *et al.,* [2].

A gradual increased in moisture content which in turn decreased the dry matter content (Table 3) was observed in our finding after a storage period of 6 months where maximum moisture content was observed in sand embedded drying as compared to silica gel which may be due to the fact that at the time of storage some silica gel were sprinkled at the bottom to avoid moisture build up only in those desiccators where silica embedded dry flowers were stored. Flowers after drying had the tendency to reabsorb moisture and wilt therefore it is recommended that the flowers should be stored and displayed in a closed container to keep out moisture [18]. Smith [21] suggested storage of flowers dried with sand in a strong carton to protect the petals from breaking. He also recommended to display the silica gel dried flowers in a closed container to keep out dust and high humidity. Silica gel crystals should be kept at the bottom of the storage containers like desiccators, glass jars or plastic jars to prevent the dried plant material from spoilage and for their future utilization [5].

Conclusion

Helichrysum was found to be the best performer in all aspects of quantitative and qualitative features of drying, followed by gerbera, chrysanthemum and marigold. Maximum loss in weight and dry matter content with minimum moisture and least drying time were observed in *Helichrysum* yellow and deep pink flowers. Darker shade of flower colour had changed to lighter shade in all the cases. White flower also change to slightly off-white which were prominent in sand drying. However, yellow colour flower was more or less same. Maximum score for brittleness as well as lowest moisture content was exhibited by *Helichrysum* yellow dried by embedding in silica gel after drying and

even after storage for 6 months and 9 months. Embedding in silica gel was found to be the best method of drying in all cases. Lowest storage life was recorded in Bidhan 1 variety of marigold when stored after sand embedded drying. However after silica gel embedded drying storage life was much longer as compared to other varieties of different flowers. Longest storage life was observed in. silica gel embedded *Helichrysum* (yellow and deep pink) flowers where moisture content after drying and even after storage was lowest. A gradual increased in moisture content which in turn decreased the dry matter content was observed in our finding after a storage period of 6 months where maximum moisture content was observed in sand embedded drying as compared to silica gel. Storage life for Bidhan 1 and Bidhan 3 varieties of marigold was only for 19 and 21 months when dried by silica gel embedding. Therefore, even though dried marigold flowers could not reached the criteria of dry *Helichrysum* flower acceptable quality attributes along with longer storage life was observed when silica gel was used as embedding media in hot air oven drying.

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Table 1: Storage life (months) of different flowers as affected by different medias and varieties

Treatment	Storage life (months)		
	2011	2012	Pooled
Media (M)			
M_1	16.79	15.50	16.14
M_2	25.86	17.00	21.43
SEm (±)	**0.09**	**0.10**	**0.07**
CD (P=0.05)	**0.25**	**0.29**	**0.19**
Variety (V)			
V_1	16.00	14.50	15.25
V_2	20.00	16.50	18.25
V_3	23.00	17.00	20.00
V_4	20.00	16.50	18.25
V_5	17.00	14.00	15.50
V_6	18.00	15.50	16.75
V_7	23.00	17.00	20.00
V_8	18.50	14.50	16.50
V_9	21.00	17.00	19.00
V_{10}	25.00	17.00	21.00
V_{11}	25.00	17.00	21.00
V_{12}	24.00	17.00	20.50
V_{13}	24.00	17.00	20.50
V_{14}	24.00	17.00	20.50
SEm (±)	**0.23**	**0.27**	**0.18**
CD (P=0.05)	**0.66**	**0.75**	**0.50**

M_1 : Sand; M_2 : Silica gel; Marigold - V_1 to V_2 (V_1 : Bidhan 1; V_2: Bidhan 3); *Chrysanthemum* - V_3 to V_7 (V_3: BC 5; V_4: BC 16; V_5: BC 41; V_6: BC 31; V_7: BC 45); *Gerbera* - V_8 and V_9 (V_8: Elegant and V_9: Calcutta pink); Helichrysum – V_{10} to V_{14} (V_{10}: Yellow; V_{11}: Deep pink; V_{12}: Light pink; V_{13}: Orange; V_{14}: White)

Table 2: PLW (%), dry matter content (%), moisture content (%), time taken for perfect drying (hours), brittleness and brightness of plant parts (as per Hedonic scale) of different flowers as affected by media and varieties after drying

Treatment	PLW (%)			Dry matter content (%)			Moisture content (%)			Time taken for drying			Brittleness of plant part			Brightness of plant part		
	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled
Media (M)																		
M_1	70.66	75.59	73.12	88.61	88.80	88.70	11.39	11.21	11.30	60.57	58.00	59.29	7.01	6.98	6.99	7.58	7.64	7.61
M_2	76.10	72.17	74.13	89.40	89.13	89.27	10.60	10.87	10.74	50.79	47.57	49.18	6.01	5.98	5.99	8.99	9.00	8.99
SEm (±)	0.46	0.48	0.37	0.08	0.09	0.06	0.08	0.11	0.07	0.46	0.49	0.37	0.04	0.08	0.04	0.02	0.07	0.04
CD (P=0.05)	1.31	1.37	0.998	0.22	0.26	0.17	0.22	0.31	0.19	1.31	1.38	1.03	0.11	0.21	0.12	0.07	0.19	0.10
Variety(V)																		

V_1	73.65	70.98	72.32	90.67	90.54	90.60	9.33	9.47	9.40	47.50	44.00	45.75	5.67	5.83	5.75	8.92	9.00	8.96
V_2	70.33	81.45	75.89	88.46	88.86	88.66	11.55	11.14	11.34	69.50	66.00	67.75	6.17	6.17	6.17	8.75	8.83	8.79
V_3	77.75	77.09	77.42	89.28	91.27	90.27	10.72	8.74	9.73	69.50	66.00	67.75	6.50	6.33	6.42	8.00	8.08	8.04
V_4	71.13	70.20	70.67	90.28	90.71	90.50	9.72	9.29	9.51	69.50	66.00	67.75	6.17	6.00	6.08	8.83	8.92	8.88
V_5	75.00	73.16	74.08	88.68	88.66	88.67	11.33	11.34	11.33	47.50	44.00	45.75	5.83	5.83	5.83	6.50	6.50	6.50
V_6	75.95	76.14	76.05	87.80	84.77	86.29	12.20	15.23	13.72	47.50	44.00	45.75	6.00	5.83	5.92	8.00	8.00	8.00
V_7	77.87	78.57	78.22	88.21	89.87	89.04	11.79	10.14	10.96	69.50	66.00	67.75	6.50	6.50	6.50	8.42	8.50	8.46
V_8	81.72	80.35	81.03	83.25	83.93	83.59	16.76	16.07	16.41	80.00	78.00	79.00	5.80	6.20	6.00	8.58	8.67	8.63
V_9	80.57	79.90	80.23	86.00	84.02	85.01	14.01	15.98	14.99	78.00	76.00	77.00	6.33	6.17	6.25	8.00	8.00	8.00
V_{10}	72.46	71.96	72.21	90.44	90.49	90.47	9.56	9.51	9.54	29.00	27.00	28.00	7.33	7.50	7.42	9.25	9.25	9.25
V_{11}	65.02	66.19	65.61	91.32	91.10	91.21	8.69	8.91	8.80	34.00	31.00	32.50	7.33	7.33	7.33	8.00	8.00	8.00
V_{12}	69.45	70.00	69.73	90.65	90.34	90.50	9.35	9.66	9.51	34.00	31.00	32.50	7.17	7.00	7.08	8.25	8.25	8.25
V_{13}	65.89	67.82	66.86	90.43	90.29	90.36	9.57	9.72	9.64	56.00	54.00	55.00	7.17	7.33	7.25	8.00	8.00	8.00
V_{14}	70.50	70.50	70.50	90.64	90.65	90.64	9.37	9.36	9.36	48.00	46.00	47.00	7.17	7.17	7.17	8.50	8.50	8.50
SEm (±)	1.23	1.18	0.97	0.20	0.24	0.16	0.20	0.29	0.18	1.23	1.29	0.89	0.10	0.20	0.13	0.06	0.18	0.10
CD (P=0.05)	3.47	3.35	2.72	0.58	0.69	0.45	0.57	0.83	0.50	3.47	3.66	2.49	0.30	0.56	0.37	0.18	0.51	0.27

M_1 : Sand; M_2 : Silica gel; Marigold - V_1 to V_2 (V_1 : Bidhan 1; V_2: Bidhan 3); *Chrysanthemum* - V_3 to V_7 (V_3: BC 5; V_4: BC 16; V_5: BC 41; V_6: BC 31; V_7: BC 45); *Gerbera* - V_8 and V_9 (V_8: Elegant and V_9: Calcutta pink); Helichrysum – V_{10} to V_{14} (V_{10}: Yellow; V_{11}: Deep pink; V_{12}: Light pink; V_{13}: Orange; V_{14}: White)

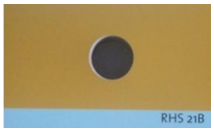
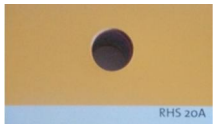
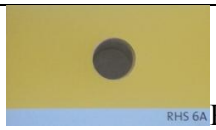
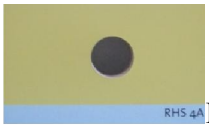
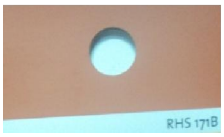
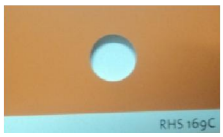
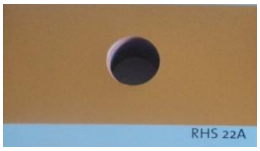
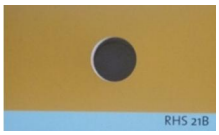
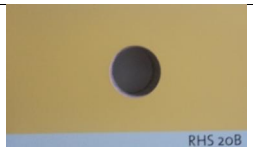
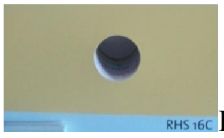
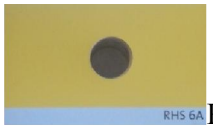
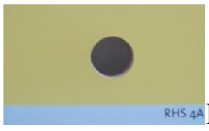
Table 3: Dry matter content (%), moisture content (%) and brittleness and brightness of plant parts (as per Hedonic scale) of different flowers as affected by media and varieties after 6 months of storage

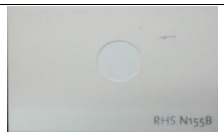
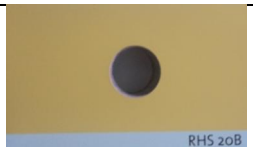
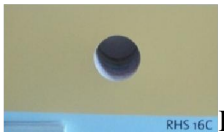
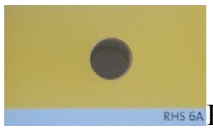
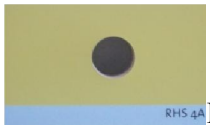
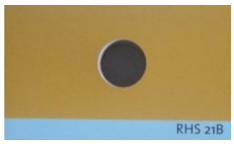
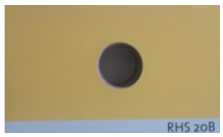
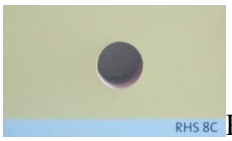
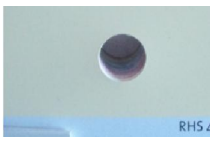
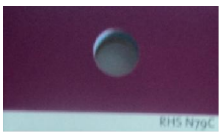
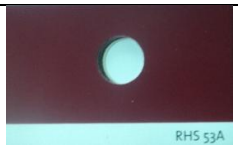
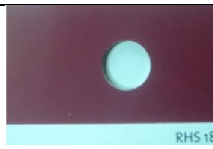
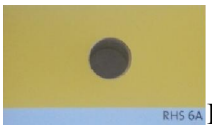
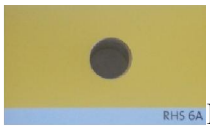
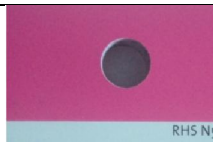
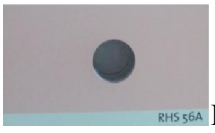
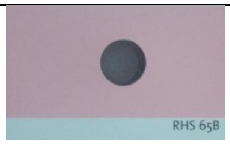
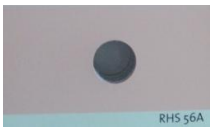
Treatment	Dry matter content (%)			Moisture content (%)			Brittleness of plant part			Brightness of plant part		
	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled
Media (M)												
M_1	79.06	79.88	79.47	20.94	20.12	20.53	5.01	4.98	4.99	6.58	6.64	6.61
M_2	80.37	79.65	80.01	19.63	20.33	19.98	6.01	5.98	5.99	8.00	8.00	8.00
SEm (±)	**0.44**	**0.52**	**0.34**	**0.36**	**0.40**	**0.27**	**0.04**	**0.05**	**0.03**	**0.05**	**0.06**	**0.04**
CD (P=0.05)	**1.26**	**NS**	**NS**	**1.03**	**NS**	**NS**	**0.11**	**0.14**	**0.09**	**0.13**	**0.17**	**0.11**
Variety (V)												
V_1	84.55	83.26	83.91	15.45	16.74	16.09	4.67	4.83	4.75	7.92	8.00	7.96
V_2	74.23	74.67	74.45	25.77	25.33	25.55	5.17	5.17	5.17	7.75	7.83	7.79

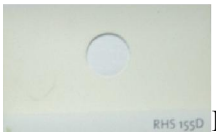
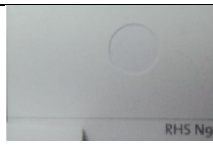
V_3	75.56	79.20	77.38	24.45	20.81	22.63	5.50	5.33	5.42	7.08	7.08	7.08
V_4	83.33	83.66	83.50	16.67	16.34	16.51	5.17	5.00	5.08	7.83	7.92	7.88
V_5	76.14	76.06	76.10	23.87	23.94	23.90	4.83	4.83	4.83	5.50	5.50	5.50
V_6	73.68	75.49	74.58	26.32	24.51	25.42	5.00	4.83	4.92	7.00	7.00	7.00
V_7	75.00	75.41	75.21	25.00	24.59	24.80	5.50	5.50	5.50	7.42	7.50	7.46
V_8	71.11	72.17	71.64	28.89	27.83	28.36	4.83	4.67	4.75	7.58	7.67	7.63
V_9	72.35	72.67	72.51	27.65	27.33	27.49	5.33	5.17	5.25	7.00	7.00	7.00
V_{10}	85.80	83.85	84.83	14.20	16.15	15.17	6.33	6.50	6.42	8.25	8.25	8.25
V_{11}	86.87	87.09	86.98	13.13	12.91	13.02	6.33	6.33	6.33	7.00	7.00	7.00
V_{12}	85.88	83.45	84.67	14.12	16.55	15.33	6.17	6.00	6.08	7.25	7.25	7.25
V_{13}	86.30	84.62	85.46	13.70	15.38	14.54	6.17	6.33	6.25	7.00	7.00	7.00
V_{14}	85.25	85.12	85.18	14.75	14.72	14.73	6.17	6.17	6.17	7.50	7.50	7.50
SEm (±)	**1.17**	**1.36**	**0.90**	**0.96**	**1.06**	**0.72**	**0.10**	**0.13**	**0.08**	**0.12**	**0.16**	**0.10**
CD (P=0.05)	**3.32**	**3.86**	**2.52**	**2.73**	**3.00**	**2.01**	**0.30**	**0.36**	**0.23**	**0.35**	**0.46**	**0.28**

M_1 : Sand; M_2 : Silica gel; Marigold - V_1 to V_2 (V_1 : Bidhan 1; V_2: Bidhan 3); *Chrysanthemum* - V_3 to V_7 (V_3: BC 5; V_4: BC 16; V_5: BC 41; V_6: BC 31; V_7: BC 45); *Gerbera* - V_8 and V_9 (V_8: Elegant and V_9: Calcutta pink); Helichrysum – V_{10} to V_{14} (V_{10}: Yellow; V_{11}: Deep pink; V_{12}: Light pink; V_{13}: Orange; V_{14}: White)

Plate 1: Change in colour intensity of dry flowers as per Royal Horticulture Colour Chart (mini) of different flowers after drying and 6 months of storage

	Sand embedded		**Silica embedded**	
	After drying	**After storage**	**After drying**	**After storage**
V1	 RHS21B	 RHS20A	 RHS 6A	
V2	 RHS171B	 RHS169C	 RHS28B	 RHS24A
V3	 RHS22A	 RHS163A	 RHS 21B	 RHS20B
V4	 RHS20B	 RHS16C	 RHS 6A	

V5	 RHSN155D	 RHSN155B	 RHS155D	 RHSN155D
V6	 RHSN155D	 RHSN155B	 RHS155D	 RHSN155D
V7	 RHS20B	 RHS16C	 RHS 6A	
V8	 RHS21B	 RHS20B	 RHS 8C	
V9	 RHSN79C	 RHS71A	 RHS53A	 RHS185B
V10	 RHS6A	 RHS4A	 RHS 12A	
V11	 RHSN57C	 RHSN57D	 RHS61C	 RHSN57C
V12	 RHS56A	 RHS56C	 RHS65B	 RHS56A

V13	 RHS28A	 RHS28B	 RHS32A	 RHS28A
V14	 RHS155D	 RHSN155D	 RHSN155B	 RHSN999D

Marigold - V_1 to V_2 (V_1 : Bidhan 1; V_2: Bidhan 3); *Chrysanthemum* - V_3 to V_7 (V_3: BC 5; V_4: BC 16; V_5: BC 41; V_6: BC 31; V_7: BC 45); *Gerbera* - V_8 and V_9 (V_8: Elegant and V_9: Calcutta pink); Helichrysum – V_{10} to V_{14} (V_{10}: Yellow; V_{11}: Deep pink; V_{12}: Light pink; V_{13}: Orange; V_{14}: White)

Group atmosphere, Task-job and Role characteristics: An interdependency approach in engineers of three large scale public sector organizations.

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Abstract— The present study was conducted in three large scale private sector organizations. From each organization, 30 engineers were chosen as respondents of which 15 were from Production department and other 15 were from Marketing department. All the subjects were male and their varied from 25 to 55 years. Group atmosphere, Task Job and Role characteristics questionnaire were used for data collection in the present study. The data were analyzed in terms of Inferential Statistics (including' test) and correlation Matrices. The production engineers of A and B organizations showed significant differences on variety, Task-completeness, Task impact, Required skill, Role Conflict, Role overload and Uncertainty; B and C organizations on variety, Task feedback, Task impact, Training adequacy, Pace control, Role Conflict, Role overload, meaningless, Responsibility and Interdependency and finally C and A organizations on Task completeness, Training adequacy, Pace control, Role conflict, Role overload, Challenge, Uncertainty and Interdependency. Similarly, The Marketing groups showed significant differences between organizations A and B on Variety, Task feedback, Task significance, Challenge, Meaningfulness, Uncertainty and Interdependency, B and C organizations on challenge, Meaningfulness, Responsibility, Knowledge of results, Uncertainty and Interdependency; C and A organizations on variety, Task significance, Role clarity, Role overload, Meaningfulness, Knowledge of results and Interdependency. The inter-correlations between the various factors was calculated for the two groups (viz. production and marketing) separately. The results were discussed on the lights of other relevant studies.

***Index Terms*—Group atmosphere, Task- job and Role characteristics**

I. INTRODUCTION

Over the last decade, enormous interest has been generated in the study of Social and Psychological aspects of life in the institutions and organizations. This is reflected in the substantial increase in training and research in the field of organizational behavior. The interrelationship between the individual, the variety of groups of different communities and the group operates, has all been the focus of attention. The interaction between the overall outputs of industrialization with the society has brought profound changes in the economic, structural and psychological aspects of the society. The different demand of the industry for human efforts and natural resources, the increased flow of goods and services has produced the most profound disturbances in individual lives, extinguished and created social institutions, substantially altered the class structure and this in turn has changed the ideologies of man. In spite of these changes man nevertheless takes the credit of being the irreplaceable backbone of industrialization because of which serves in various capacities giving out the best of his skill and qualification in different type of jobs assigned to the person. Furthermore, man/woman has to change or adjust the aims of his/her to the needs of industry and its purposes.

In a similar fashion for any organization to work, there is also a need for rational coordination of the activities of a number of people for the achievement of some common purpose or goal through division of labour, functions, authority and responsibility. The investigators from different fields like Sociology, Anthropology, Psychology and even Medical Sciences are devoting much of their time and efforts to understand and evaluate man as well as industry, and formulate methods for betterment and upliftment of both.

Group atmosphere is an important group process and Fiedler (1962), describes group atmosphere in the context of general affective environment within a unit, whereas researchers has emphasized much attention devoted to analyzing various group atmosphere aspects and group level outcomes (Rajendran, 2005; Sharma, 2005). A few studies have been conducted on how group atmosphere effects individual worker outcomes (Adler et al., 1985; Choi *et al.*, 2003; Jehn & Chatman, 2000; Jehn & Mannix, 2001; Mossholder, Bedeian & Amenakis,1982). Choi *et al.(*2003) argued that researchers have not focused on what role leaders play in influencing group atmosphere and workers perception of the same.

Pingfeng (2011) suggests that effective knowledge sharing may enhance competitive capabilities and respond better to business opportunities for organizational growth. Riege (2005) remarked that knowledge sharing is a process in which individual or organization passes the knowledge (professional knowledge, skills, experience, values, etc.) owned by itself, to the other individual or organization through the appropriate channels and these knowledge refreshed in an order of the original or new form. It is not only a simple way of sharing information, but also helps others as an individual or groups to develop new skills. To achieve the goals or mission and vision, the enterprise may build knowledge management systems (KMS), to create conducive organizational climate and attitude (Shiuann-Shuoh et al., 2012). To build knowledge management systems (KMS), some psychological factors such as cultural characteristics, individual characteristics and the

interpersonal team relationship also have an influence on the knowledge sharing (Sheng and Raymond, 2010). These exchanges have an impact on psychological wealth (such as enjoyment, spiritual support, etc.), as well as social wealth (such as access to identity, status, prestige, etc.) and psychological contract is the basis to motivate staff under transaction contract (Chen et al., 2009). Huber (2001), observed that social and psychological factors have an impact on employees' knowledge sharing behavior and organizational climate is an important drive in the process of knowledge sharing (Farh et al., 2004).

In an industrial organization, a task given to a person - its proper execution and resulting output is an index of human effectiveness. A task may be assigned to a person by an external agent or may be self generated; it consists of a stimulus complex and a set of instructions which specific what is to be done. The instructions indicate what operations are to be performed by the subject with respect to the stimuli and what goal is to be achieved. The task environment has an impact on the goals and values, structure, technology. Human relationships and management processes within organizations. The objectives or factual characteristics of the environment affect organizations but the perception and beliefs of internal members are equally important. Information from the outside passed through perceptive and cognitive processes result in decision affecting internal characteristics of the organization. Recently, many organization theorists have focused their attention on the environment and its impact on organizational functioning. This trend is illustrated by the empirical research efforts published by such writers as Dill (1958), Burns and Stalker (1961), Emery and Trist (1965), Thompson (1967), and Laurnece and Lorch (1969).

The study of perceived task characteristic and the manner in which the employees react to these characteristics has become an increasingly important research theme. In general, it has been suggested that the employee's perception of task characteristics such as variety, autonomy, feedback and identify will be positively associated with the outcome variables such as satisfaction, motivation, commitment and productivity. These positive relationships may be stronger for those employees who have strong needs for personal growth and achievement.

The job characteristics model proposes that existence of skill variety, task significance, task identity, autonomy, and feedback among employees have a favourable feelings and experiences which boost the employees beneficial work outcomes as like intrinsic work motivation (Hackman and Oldham; 1980), job satisfaction (Tiegs et al., 1992; Goldstein, 1989; Becherer et al., 1982) organizational commitment (Hunt et al., 1985, Ramswami,et al., Agarwal and Bhargava; 1993).

Research studies of Bhuin and Menguc(2002); Bhuian et al., (2001); Morley and Flynn (2004); Naumann (1993); Nauman et al., (2000) revealed that job characteristics and work adjustment has a positive influenced to work adjustment. Pi and Huang (2011), and Hee and Ling(2011) suggest that greater autonomy is associated with improved teamwork and personnel growth, better morale and greater responsibility towards work which leads the employees higher levels of satisfaction and motivation. Positive feedback increases workers sense of task competence and accomplishment, decreases stress and burnout, increases job satisfaction (Hee & Ling; 2011; p.1061).

Weed and Mitchell (1980) have found that true degree of task structure has a major role on uncertainty perceptions experienced by individuals. Their findings are suggestive of the possibility of an optimum degree of task structure in relation to perceptions of ambiguity and uncertainty in employee roles. Dunham's (1977) study revealed that those persons who perceived the organizational climate as least favorable were most likely to respond positively to such jobs. Walah et al. (1980) have developed a model of interactive effects of organizational setting and informational cues as determinants of perceived job characteristics.

II OBJECTIVES OF THE STUDY

The objective of the present study is to study the differential effects of perceived environmental factors and the experience of group astrosphere of engineers at different groups.

III Hypotheses of the study

As discussed in the previous section, it is expected that group atmosphere perceptions will significantly and positively effect on worker performance and task job and role characteristics. Based on this, the following hypotheses were formulated.

Hypotheses:

i). There will be difference among the production units of three organizations on the basis of task--job and role characteristics.

ii). There will be difference among the Marketing units of three organizations on the basis of task-job and role characteristics.

iii). The task-job and role characteristic factors will be related to group atrmospheric factors in all the groups.

iv). All the organizations will differ significantly in the perception of environmental factors

IV METHODS OF THE STUDY

Sample: A total number of 90 engineers were selected from three private sector organizations. However, these organizations are referred to 'A', 'B' and 'C'. The organization 'A' is an automobile manufacturing unit. The organization 'B' is the Multi-product diversified company and the organization 'C' is a public Limited company. From each organization, 30 engineers were chosen as respondents, of which l5 were from production department and the other 15 were from marketing department. All the subjects were male and their age varied from 25 to 55 years.

Instruments: The following instruments were used for data collection in the present study:

1) ***Group Atmosphere questionnaire:***

This questionnaire was developed by Fiedler in 1967. This questionnaire mainly measures the different social environmental factors of a group. In this study the researchers used this questionnaire to measure the engineer's perception of the climate of his work group with respect to member-member relationships. This questionnaire consists of l0 items and it is a 8 point scale.

(2) ***Task-Job and Role Characteristics questionnaire***: To study the perception of engineers of task-role and job characteristics in the organization the Michigan organizational assessment questionnaire was used. This questionnaire was developed by Seashore, Lawler, Mirvis and Cammann (1982). The questionnaire consists of 46 items and it is a 7 point scale.

This questionnaire measures 18 factors of the task-job and role characteristics.

***Procedure**:*

At first the General managers of the selected enterprises were contacted for their co-operation in conducting the research. The list of engineers (production and marketing) in each enterprise was prepared with the help of the administrative officer. Then the listed persons were contacted individually. Each subject was told that it was an academic investigation and his personal identity would be kept confidential. The questionnaires were administered to each of the persons. Scoring was done following the procedure provided by the respective author of the test administered.

V ANALYSES OF THE DATA

The analyses were done by means of Inferential Statistics which included t-test to find out the significant differences if any between means related to different groups of engineers on each dimensions. SPSS (Statistical Package for Social Sciences) were used for analyzing the data. Finally, correlation matrices were drawn among the variables for the A, B and C organization. There were l9 variables in the study and all the l9 variables were compared among the different engineer groups.

VI RESULTS

The results are presented are presented in Table 1,2,3,4,5,6,7,8,9 and 10.

Table 1,2,3,4,5,6,7,8,9 and l0 are about here.

Table - l, Presents the significance of mean difference between production engineers from organization A vs. B.

Table - 2. Presents the significance of mean difference between production engineers from organization B vs. C.

Table-3. Presents the significance of mean difference between production engineers from organization C vs. A.

Table - 4, Shows the significance of mean difference of Marketing engineers from organizations A vs. B

Table- 5, Shows the significance of mean difference of marketing engineers from organizations B vs. C.

Table - 6 shows the significance of mean difference of marketing engineers from organization C vs. A.

Table - 7 Presents the significance of mean difference between engineers of marketing and production from organization A.

Table - 8 presents the significance of mean difference of between engineers of production and marketing from organization B.

Table - 9 . Shows the significance of mean difference between engineers of production and marketing from organization C.

Table - 10 depicts the significant correlations of perceived group atmosphere factor and task-job and role characteristics of production and marketing unit engineers from organization A. B. and C.

VII DISCUSSION

The results have already been presented in the previous section. While comparing the two groups the result (Table -l) showed that the production engineers of organization 'A' perceived the presence of Variety (M=14.9) and Task impact (M=11.5) higher than the production engineers of organization B scored (M=2.6) and (M=9.9) for these factors which are significant at .05 level and .01 level respectively. This finding reveals that the engineers of organization 'A' perceived their job full of varied activities while the organization 'B' engineers perceived their jobs are monotones and boring. The two groups also differed significantly on task completeness required skill, role conflict, role overload, and uncertainty. The overall observation of the production unit of organization 'A' suggest that the environment of this organization enhance the perception of freedom, variety, task feedback, role clarity and challenge. It can be assumed the jobs high on these positive factors are perceived as more significant and contributing for the effective performance of the individual. On the contrary, the production unit engineers of organization 'B' showed relatively low mean scores for organizational environmental factors.

From Table – 2, it can be seen that the production engineers of organization 'B' and 'C' differed significantly on 'variety', 'task feedback', 'task impact'. 'training adequacy'. 'pace control', 'role conflict', 'role overload' 'meaningfulness'. 'responsibility' and 'interdependency'. These values showed that the production unit engineers of organization 'C' achieved higher mean scores in all the organizational factors while the production unit engineers of organization 'B' had low scores on the factors such as variety, task feedback, meaningfulness and responsibility. These results were found in agreement with Hackman and Oldham (1976). These investigators suggested that jobs higher in skill variety, autonomy, task significance and task feedback will create a greater experience of meaning, responsibility and knowledge of results leading towards greater job satisfaction, higher internal work motivation, better work performance and lower levels of absenteeism and labour turnover.

From Table -3, it can be said that the Production engineers of organization A and C differed significantly on task completeness, training adequacy, pace control, role conflict, role overload- challenge. Uncertainty, and interdependency, For all the above factors the engineers of organization 'C' achieved higher mean scores which is suggestive of the fact that the presence of these factors enhance the experience of meaningfulness in their job. Thus, it is apparent that the production unit of organization 'C' is superior in terms of working environment than the production Unit of organization 'A'.

Table 4 depicts that the marketing engineers of organization 'A' and 'B' showed significance difference on variety, task feedback, task significance, challenge , meaningfulness, uncertainty and interdependency. The marketing engineers of organization 'B' achieved high mean scores for factors variety while marketing engineers of organization 'A' obtained a low score. This implies that the marketing engineers of organization 'B' deal with jobs which involve varied activities and engineers from organization 'A' deal with tasks of little variety. Further, the perceived presence of variety was found contributing, in the perceived presence of challenge and meaningfulness. Thus, it can be concluded that the engineers from organization 'B' perceived their working environment as pleasant and significant but a separate consideration of organization 'B' showed that their environment is also not very significant.

Table –5, Showed that the marketing engineers of organization 'B' and 'C' differed significantly on challenge, meaninglessness, responsibility knowledge of results, uncertainty and interdependency. It is summarized that the engineers of organization 'C' perceived the Combine presence of knowledge of results , meaningfulness, responsibility and

challenge and all these factors contribute in the effectiveness of this group.

From Table 6. it can be seen that the marketing engineers of organization 'A' and 'C' differed significantly on variety, Task significance, Role clarity, Role overload, meaningfulness, knowledge or results and interdependency. The engineers from organization 'C' deal with varied activities while engineers from organization 'A' perceived their group activities as monotonous. Thus, it can be assumed that the engineers of this group are adversely affected by the environment.

Again, while comparing the engineers of production and marketing units of organization 'A (Table-7) , it is found that they differed significantly on Freedom, Task completeness orientation. task significance, role overload, knowledge of result, uncertainty and interdependency. Comparatively the marketing engineers achieved higher score than the production group. The result indicates that the marketing engineers who deal with the people from outside the organization, perceived more freedom while the production groups perceived the futility of word freedom because their activities are very limited due to environmental constraints. Thus, it can be assumed that marketing engineers work in more free dynamic and positive environment which may enhance their effectiveness.

It is evident from Table - 8 that there is not much significant difference for many factors in this organization suggesting that the two different departments of this organization are more or less similar in terms of the internal work environment in the organization.

Similarly, Table -9 shows that means of these factors as obtained by the engineers of two units and this shows that the two units are not very significantly different from each other but the general environment of the organization is significant, encouraging and contributing to the effectiveness of engineers. From Table – 10, it can be said that the six groups in three different organizations showed common significant variables only on freedom, task impact and responsibility. This might be attributed that freedom impact in their tasks and roles (responsibility), thereby indicating that psychological freedom and task impact and responsibility- are the essential environmental conditions for the creativity of the individuals. Amiri et al. (2013) in a study found that there is a positive correlation between the components of job characteristics (autonomy, task identity, feedback and job challenge) and job commitment.

VIII CONCLUSION

This study has shown that group atmosphere perceptions can significantly effect individual worker performance through, task-job and role characteristic. From the above discussion it can be said that the results obtained in the present study partially fulfill the hypotheses. The final conclusion of this study is based on Unit wise comparisons of perceived environmental factors are - (i) the engineers of organization ‘C’ either work in a significant environment or perceived it to be so. (ii) The engineers’ from organizations 'A' and 'B' have environments which are not supportive or contributory to their full effectiveness. Research studies (Kassem and Sarhan (2013), Bhatti et al., (2012), Said and Munap (2011),Ali et al (2014) revealed that all the job characteristics increase job satisfaction and Al-Tit and Hunitie (2015) found that there is a positive relationship between feedback and job satisfaction. Ling and Loo (2015) suggest that the most important job characteristics that affect job satisfaction are work autonomy and task significance. While these results are encouraging, more work needs to be undertaken on this topic. Future research should be conducted on how group atmosphere, and other group characteristics, effect individual worker outcomes. The outcome of the study can help business organizations to develop guidelines that facilitate the development of group atmosphere in relation to task-job and role-characteristics. It is evident from the previous research findings that job characteristics are important in designing employee’s behaviour and attitude. Future research could examine the same variables from managers’ perspectives and/or in other settings. Moreover, in a larger sample, data may be collected from Govt. vs. Private, Male vs. Female, Rural vs. Urban to clarify the direction of the relationships and also to increase the generalizability of the results.

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Table-1: Significance of mean difference between Productions Engineers from organizations A vs.B

Name of the variables	Organization 'A' Production Engineering Mean Value (N=15)	SD	Organization 'B' Production Engineers Mean Value (N=15)	SD	't'
Variety	14.9	3.81	12.6	3.72	2.37*
Task Completeness	7.9	2.37	9.4	2.46	2.34*
Task Impact	11.5	1.72	9.9	2.34	3.02*
Required skill	15.7	3.71	17.9	2.99	2.53*
Role conflict	6.9	3.59	11.6	2.97	5.5**
Role overload	9.0	2.64	17.7	3.06	11.76**
Uncertainty	11.26	3.95	13.9	3.11	2.87**

*P<.05 **P<.01

Table-2 : Significance of mean difference between Production Engineers from organizations B vs.C

Name of the variables	Organization 'C' Production Engineering Mean Value (N=15)	SD	Organization 'B' Production Engineers Mean Value (N=15)	SD	't'
Variety	16.6	2.87	12.6	3.72	4.65**
Task Feedback	11.6	2.50	10.0	3.08	2.22*
Task Impact	11.13	2.17	9.9	2.34	2.12*
Training Adequate	18.3	2.7	15.0	3.93	3.79**
Pace Control	17.2	2.6	14.0	5.61	2.83**
Role Conflict	8.9	3.8	11.6	2.97	3.07**
Role overload	11.9	5.2	17.7	3.06	5.27**
Meaningfulness	12.8	.77	11.9	1.67	2.65*
Responsibility	13.1	1.03	12.2	1.97	2.19*
Interdependency	12.5	1.80	9.50	3.11	4.54**

*P<.05 **P<.01

Table-3 : Significance of mean difference between Production Engineers from organizations C vs.A

Name of the variables	Organization 'A' Production Engineering Mean Value (N=15)	SD	Organization 'B' Production Engineers Mean Value (N=15)	SD	't'
Task completeness	10.2	2.98	7.9	2.37	3.33**
Training adequacy	18.3	2.7	16.6	3.29	2.18*
Pace control	17.2	2.6	14.2	3.84	3.53**
Role conflict	8.9	3.8	6.9	3.59	2.11*
Role overload	11.9	5.2	9.0	2.64	2.74*
Challenge	24.3	4.1	21.3	6.35	2.17*
Uncertainty	15.1	2.9	11.26	3.95	4.31**
Interdependency	12.5	1.8	10.8	2.88	2.74*

*P<.05 **P<.01

Table-4 : Significance of mean difference of Marketing Engineers from organizations A vs.B

Name of the variables	Organization 'A' Marketing Engineering Mean Value (N=15)	SD	Organization 'B' Marketing Engineers Mean Value (N=15)	SD	't'
Variety	13.4	3.58	16.3	3.46	3.19**
Task Feedback	10.9	1.96	9.0	3.42	2.64*
Task Significance	12..2	2.24	10.0	2.95	3.24**
Challenge	19.8	3.53	24.0	4.52	4.0**
Meaningfulness	11.5	1.96	12.5	.83	2.56*
Uncertainty	14.8	4.25	17.1	4.03	2.15*
Interdependency	8.9	2.19	10.7	2.94	2.84**

*P<.05 **P<.01

Table-5 : Significance of mean difference of Marketing Engineers from organizations B vs.C

Name of the variables	Organization 'C' Marketing Engineering Mean Value (N=15)	SD	Organization 'B' Marketing Engineers Mean Value (N=15)	SD	't'
Challenge	13.19	9.10	24.0	4.52	2.62*
Meaningfulness	13.0	.93	12.5	.83	2.17*
Responsibility	13.1	.96	12.3	1.91	2.65*
Knowledge of Results	14.4	2.67	11.5	3.09	3.82**
Uncertainty	13.5	4.51	17.1	4.03	2.27*
Interdependency	12.8	2.04	10.7	2.94	3.23**

*P<.05 **P<.01

Table-6 : Significance of mean difference of Marketing Engineers from organizations C vs.A

Name of the variables	Organization 'A' Marketing Engineering Mean Value (N=15)	SD	Organization 'B' Marketing Engineers Mean Value (N=15)	SD	't'
Variety	17.3	2.47	13.4	3.58	4.94**
Task Feedback	10.7	2.96	12.2	2.24	2.21*
Role Clarity	15.3	3.77	18	1.79	3.55**
Role overload	13.06	4.96	15.8	4.39	2.26*
Meaningfulness	13.0	.93	11.5	1.96	3.58**
Knowledge of results	14.4	2.67	11.1	1.19	6.23**
Interdependency	12.8	2.04	8.9	2.19	7.09**

*P<.05 **P<.01

Table-7 : Significance of mean difference of Production and Marketing Engineers from organizations A

Name of the variables	Organization 'A' Production Engineering Mean Value (N=15)	SD	Organization 'A' Marketing Engineers Mean Value (N=15)	SD	't'
Freedom	16.5	3.39	18.5	2.09	2.74*
Task completeness	7.9	2.37	9.9	2.71	3.03**
Task Significance	9.4	2.92	12.2	2.24	4.18**
Role overload	9.0	2.64	15.8	4.39	7.23**
Knowledge of results	12.4	2.13	11.1	1.19	2.89**
Uncertainty	11.26	3.95	14.8	4.25	3.34**
Interdependency	10.8	2.88	8.9	2.19	2.88**

*P<.05 **P<.01

Table-8 : Significance of mean difference between Production and Marketing Engineers from organizations B

Name of the variables	Organization 'B' Production Engineering Mean Value (N=15)	SD	Organization 'B' Marketing Engineers Mean Value (N=15)	SD	't'
Variety	12.6	3.72	16.3	3.46	4.30**
Task Impact	9.9	2.34	11.9	2.31	3.33**
Role overload	17.7	3.06	15.0	3.28	4.15**
Uncertainty	13.9	3.11	17.1	4.03	3.44**

*P<.05 **P<.01

Table-9 : Significance of mean difference of Production and Marketing Engineers from organizations C

Name of the variables	Organization 'C' Production Engineering Mean Value (N=15)	SD	Organization 'A' Marketing Engineers Mean Value (N=15)	SD	't'
Variety	14.9	3.81	17.3	2.47	2.56*
Task feedback	10.7	1.91	11.06	4.57	2.56*
Task Impact	11.5	1.73	11.73	2.71	4.58*
Role conflict	6.9	3.59	9.3	3.54	2.53*
Role Clarity	16.8	3.00	15.3	3.77	1.79*
Role overload	9.00	2.64	13.06	4.96	3.83**
Knowledge of Results	11.4	2.13	14.4	2.67	4.41**
Uncertainty	11.26	3.95	13.5	4.51	2.52*
Interdependency	10.8	2.88	12.8	2.04	3.23**

*P<.05 **P<.01

Table-10 : Correlation of perceived Group atmosphere and task job and Role characteristics of Production Unit Engineers and Marketing Unit Engineers from Organizations A,B and C

Variables	A		B		C	
	Production N=15	Marketing N=15	Production N=15	Marketing N=15	Production N=15	Marketing N=15
Freedom	64*	54*	56*	56*	56*	52*
Variety					68*	
Task Feedback					54*	57*
Task Completeness	64*			64*		
Task Impact	62*			56*	74*	59*
Task Significance	62*		54*			
Training adequacy					54*	54*
Required skill	56*					
Pace control				54*		
Role conflict	58*		72*	56*		
Role clarity	54*				55*	54*
Role overload					54*	
Challenge	67*				52*	
Meaningfulness					64*	52
Responsibility	55*	54*		54*	52*	56*
Knowledge of results			63*			
Uncertainty						
Interdependency			54*			
Group atmosphere						

*P< .05