Micro Planning Parameters In Process House

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Abstract

In the textile industry the fiber will be in natural colour, but often we need to add preferred color to the fiber / fabric to add the value for the product and / or as per the end use of the customer preference. To add the color to the fiber / fabric is called the coloration process or dyeing process. In this paper the author tries to understand the various parameters involved in the dyeing process house. Discussed the identified parameters in detailed, and how the parameters influence the decision making process in various situation. The decision making involves various aspects of the production process and the availability etc., the understanding will help to sequence the products under various situations in practice, so that it will enhance the optimum utilisation of facilities, manpower, resources and customer satisfaction.

Keywords: Process house, Dyeing, Process, Parameters, Knitting, Scheduling.

Introduction

The first part of the paper discuss the overview (journey) of the cotton from the field to finished product in textile industry, the second part identifies the list of parameters involved in the dyeing process house, and the third part discuss the effects of the different parameter under different situation.

Textile industry is complex in nature. Textile industry uses natural fibers and synthetic fibers. Natural fibers can be obtained from plants and animals. Cotton is one of the natural fibers which are used in the textile industry. Cotton Textile industry starts the journey from the field by the farmers in the form of cotton. Cotton is the basic raw material for cotton textile industry. From field to ginning process, in the ginning where the seeds and unwanted materials will be removed from the cotton. The cotton comes out in bale form then moved to the next process of making the bale form to yarn form by using the spinning process. The yarn will comes out of the spinning process in cone form, from then it converted in to fabric. The fabric can be constructed in two ways. One of the methods of constructing the fabric is by using the weaving process and another way of constructing the fabric is by using knitting process. These fabrics are value added with colors and prints in the process house as required, by using the dyeing process and printing process. Alternatively fabrics can be produced with colored yarn as well, were the process house takes cares the coloring the yarn. The fabric then moved to different purpose based on the end use, as home furnishing, apparel, and for various industrial applications.

Apparel business is a fashion based one. In apparel manufacturing the fashion plays a major role. The time line based fashion creates apparel business to respond in the stipulated time frame. Fashion in apparel demands lot of creative work which can be converted to be a product that has to be socially acceptable and viable to produce in bulk. In some cases the high fashion apparels required very less is numbers which leads to difficulty in producing the products as required.

The process of apparel making starts with the design which is forecasted for the future time period. The forecast is clubbed with creative work and the designer start working on design. The design will be converted into preliminary samples which may reflect the basic design and the concept. Once the concept and basic design outcome is convinced, then necessary changes will be incorporated to become a final design.

Dyeing Process

In the textile industry the fiber will be in natural colour. Depends on the end usage the fabric / yarn have to go through various chemical treatments to meet the specific requirement. This process is take place in the process house, where they value add the yarn / fabric with various sequence of process. One of the parts of this process is called coloration / dyeing. The customer / end user always prefers to be his / her own choice of own taste.
In this paper the author tries to understand the various parameters involved in the dyeing process house. Discussed the identified parameters in detailed, and how the parameters influence the decision making process in various situation. The decision making involves various aspects of the production process and the availability, etc., the understanding will help to sequence the products under various situations in practice, so that it will enhance the optimum utilisation of facilities, manpower, power resources and customer satisfaction.

Scope

Our scope is limited to dyeing process house for knitted fabric. The parameters are common in nature which can be applied to woven process house as well.

Parameters For Scheduling

The following are the parameters identified in the process house used for scheduling. The identified parameters are practically used in the industry.

1. Machine Type
2. Number of Machines
3. Quantity
4. Lab Dip
5. Product / Material
6. Other Materials
7. Weight of the fabric (GSM)
8. Raw fabric lot
9. Process Route
10. Delivery date
11. Urgency / Priority / Delay
12. Split orders
13. Additional orders
14. Similar orders
15. Outside activities
16. Final Product Combination
17. Machine Breakdown
18. Mean Time to Repair
19. Consistency
20. Failure rate
21. Re-work rate

1. Machine Type

In textile dyeing process house the main part is the dyeing machine. Dyeing machines come with different capacity. The major classification as Sample dyeing machines and Bulk dyeing machines, the sample dyeing machine are available with lesser capacities and the bulk dyeing machines are available in bigger capacities to facilitate the bulk quantity in one dye bath. All the capacities mentioned for the machine is the maximum amount of quantity which can be processed in a single dye bath.

<table>
<thead>
<tr>
<th>Dyeing Machine Type</th>
<th>Capacity in KGs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Dyeing Machine</td>
<td>10,15,20,25,&amp; 50</td>
</tr>
<tr>
<td>Bulk Dyeing machine</td>
<td>150,300,450, 600, 900 &amp; 1200</td>
</tr>
</tbody>
</table>

Source:http://www.texfabindia.com
Based on the business operation the various sizes of machines will be decided at the time of setting up the plant. Smaller capacities used for sample making purpose and also for shortage quantities. According to the size of orders appropriate capacity machine would be chosen at the time of order booking for giving a delivery date. It would be ideal to be combining the smaller orders which are same type of material / product.

2. Number Of Machines

Every plant required a set of machines to get the finished products. The scheduling will be based on the dyeing machine. Allocating the machine can be made based on the order size with the number of machines available. To do the optimum utilization of resources, higher capacity machines are allocated to big orders, so that the lot to lot variation is minimized. Order quantity to machine capacity is consider for tentative schedule to arrive the tentative delivery date. The delivery is not only limited to number of dyeing machines available but the delivery depends on the machines available for the rest of the process to complete the product as required by the customer.

3. Quantity

Quantity is one of the main constrain while deciding the machine. The regular bulk quantity order does not face much issues, some situation will arise to process small quantity. The following situation may exist for small quantity requirement, production shortage / quality / wrong doing in production / miss calculation / shade variation / in some cases after doing the bulk production some shortages may happened

4. Labdip

Lab dip is the base for any order for processing in the bulk dyeing. Lab dip is the process of matching the colour to the standard colour with actual fabric with different set of recipes in the lab setup. The output is compared to the original and the closest matching will be taken as the base recipe for the bulk. The fabric lot plays a major role in the lab dip recipe and bulk recipe. The variation in the fabric lot could lead to change in the recipe. When there is a change in the fabric lot, once again the lab dip recipe need to be confirmed by using the new fabric lot which is going for the bulk dyeing.

5. Product / Material

The final product output will give you an idea about what are the materials required for the conversion process, what type of process / dyeing method to choose. All the products are not necessary to carry out all the operations, certain products required additional operations as well. The number of operations required is purely based on the product requirement.

Material has classified as the base input material and other materials, the base material mainly referred as the fabric. The fabrics are classified based on the type of yarn used and the type of the construction. Different types of knitted fabrics are there, based on the construction the fabrics are classified as Single Jersey, Pique, Interlock, Rib, Jacquard, Mesh, Fleece, Lactose, and Waffle.

6. Other Materials

The other material includes the dyes and chemicals. The dyes part need to be very careful, the availability of the particular dye which has been used for the preparation of Lab dip. If we don’t have enough quantity of dyes then we need some more quantity to complete the order. The new quantity of the same dye we will get with different lot number. It has been observed that different lot production dyes may lead to slight variation in the output for the same quantity of dyes used for the same quantity of the fabric. It is advisable to do another lab dip with respect to the new lot.

The availability of chemical with sufficient quantity, some special finishing process required special chemicals which may be calculated at the time of order acceptance time. Normally material requirement planning is not done for each and every order. The general chemicals requirements are calculated based on their average monthly consumption. Special purpose chemicals are ordered based on the confirmed orders and expected orders.

7. Weight Of The Fabric (GSM)
The weight of the fabric is also one of the factors. The weight of the fabric is decided by the density of the yarns and the thickness of the yarns used for the construction of the fabric. The fabric weight shall be denoted as Grams per square meter (GSM). The same type of fabric can be clubbed in one dye bath. If we have a few small orders with the same type of fabric and final product is same, then we can club these small orders together and put in a single batch of dyeing. Mixing of different construction of fabric in single batch of dyeing is not advisable. Some cases the different constructed fabric will go in a single garment with same color, if we dye the same in different batches or in different machine there will be some difference in the shade of colours, to avoid the shade variation the different fabric will be done in one batch of dyeing.

8. Raw Fabric LOT

The raw fabric is called as greige fabric. The fabric is made by the process of knitting / weaving and without a coloration process or any chemical treatment done on the fabric. The greige fabric will be identified with lot number. Basically this lot numbers as varying based on the lot number of the yarn which has been used in the process of conversion to fabric. Mixing of two different lot or various lot numbers in the same dye bath may result different in the absorption percentage of dye. This results the shade variation between fabrics. Some case it may cross the acceptable level of deviation, either when compared to the standard (lab dip) or within the lot.

9. Process Route

The process route is one of major decision making factor for scheduling a job in the textile process house. Depends on the final product requirement the sequence of the operations is decided. The requirement of operations varies as the product varies, at the same time the sequence also varies to some extent.

10. Delivery Date

The delivery date is the one when the order supposed to be delivering to the customer. Normally customer request a delivery date before placing an order. It depends on the available capacity at that time of booking the orders; the delivery date may be confirmed to the customer. After accepting the delivery date the customer may place the order. Due course, the customer may request either to advance / postpone the delivery date as confirmed earlier. Need to be considered as case to case basis with respect to the effect on the other orders.

The delivery date is one of the important factors in the supply chain for each and every process which is involved in the total conversion process as required by the customer. Any of the process delays in the chain has the cascading effect to the final product.

11. Urgency / Priority / Delay

Based on the customer request either an order which has been already placed / or a new order which has to be executed on the priority basis. May considered for the long term customer / customers have trouble, in this case some of the orders need to be identified which can be delayed. Some cases may happen due to internal supply chain issues, needs to conveyed properly with the revised dates to the customer in advance.

12. Split Orders

Customers may place a bulk orders which can be delivered over a period of time. May helpful to book the capacities in advance, can be replaceable with some last minute changes. Can be identified well which can go / combined with other orders.

13. Additional Order

The customers may place orders in different time period based on his customer request / production plan. Need to look for the same type of orders which can be combined in the process to utalise the maximum capacity of the dyeing machine. If the order is already processed in the same process house and additional quantity has been placed, then need to match to the original colour.
14. Similar Order

Different customers order may run parallel, need to look for the same type of orders / product has placed by different customers. Identify the same type of products to combine to have the better utilisation of the machine and to avoid unnecessary repeated steps to be followed. May vary with the delivery dates but when the delivery dates are closer periods can be considered for combining.

15. OUTSIDE ACTIVITIES

As per the customer end product requirement, some process required specialised process. This special process may not have in house facilities. The non-availability of the facility has to take care by doing the same with the outside facility where available. This type of process may in between (after doing some process in the process houses it may go out and come back for further process) or it may happen after the completion in the process house.

16. Final Product Combination

The customer may place orders for multiple colors of fabric or same color with different fabric. Customer may be using the different type of fabric with the same colour in the final product. In this case where possible the same color of different fabric has to be taken in the same dye bath. For this the customer will inform his requirement in advance at the time of placing the order. We may not utilise the full capacity of the machine at the same time need to full fill the customer requirement.

17. Machine Breakdown

As the preventive maintenance place an important role in the process house, many breakdowns can be avoided. The dyeing process is primarily the reaction of dyes and chemical exposed to the fabric at certain period with the controlled atmosphere. The breakdown of machine in between the process will leads to the non-desired output. Need to maintain the number of breakdown to minimize to better utilisation. Allow fixed time for the scheduled maintenance for each machine at the time of booking the orders.

18. Mean Time To Repair

The average time required to get the machine to operational. The frequency of the machine down time and the time required to repair. This will decide how much time to be allowed as planned down time so that the planned down time is not allowed to book the capacities.

19. Consistency

The output of the each process measured based on the result when compared to the standard. If the process output deviation is within the acceptable limit, then the product does not required a rework. The process variation with in the limit will be reliable for a particular machine with the consistency of the output.

20. Failure Rate

The failure rate to be measured in all aspects with respect to time, availability of material, availability of machine, availability of skilled person, due to quality of material, due to machine, due to knowledge, due to handling, due to handling material, and due to protocols, etc. The past history of failure will alert to some precaution measurement before executing and orders.

21. Re-Work Rate

The process variation is not in the acceptable limit and within the repairable limit will allow as re-working of the product to get the right result. This leads to extra consumption of various resources. Leads to not able to meet the delivery date for that particular order, even these effects the rest of the order which has been scheduled latter as well.

Assumptions

While doing the scheduling the following assumption are taken
• Assuming that power is available all days without a failure.
• Power failure will have sufficient back up to run the entire unit
• The plant is running 24 hours per day with decided number working days

Conclusion

This paper helps us to understand the different parameters which are involved in the process house. Given a deep understanding on how these parameters practically involved in the process and how these contributes the effect on the final outcome of the product. The mentioned parameter will take care most of the scheduling related issues in the process house leaves as better planner for tomorrow.

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