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APPLICATION OF QUALITY MANAGEMENT TOOLS IN PLASTIC EXTRUSSION PROCESS

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ABSTRACT: *This paper discus the major role of (TQM) Total Quality Management, the current situation of industry was studied the suitable tools were implemented successfully, to eliminate the problems faced in an industry. Available machines are ultrasonic welding machines and extruder machines; studied by applying Statistical process control, taken the preliminary test to identify the issues of the machines and implement suitable tools such as PDCA cycle, Brainstorming technique and New seven tools and old seven tools technique. These tools will help to control or prevent the quality issues and the systematic approach has been done through this process.*

Keywords: *PDCAcycle, Brainstorming technique, old seven tools*

1. INTRODUCTION

This paper has been carried out in a plastic industry which is situated near Chennai. Important role of this paper is implementing and approaching TQM concepts, in a systematic approach. Daily data's are taken and studied the various types of issues which are currently present in the industry while continuous improvement process has been implemented and carried out to develop our processes continuously. Then old seven tools has been implemented currently and analyzed whether it suits or not. In that causes and effect diagram has shown clearly what are all the causes affecting our process and what are all the positive effects can be taken to solve with the help of Brainstorming technique.

1.1 Types of issues identified applying seven tools:

- Single characteristics (doesn't have any relation to other issues)
- Multi characteristics (it's have relationship to other issues)

1.1.1. Single characteristics:

In this process various rejections will occur, but it doesn't have any relationship with each other. One problem and one solution which are independent are identified by statistical process control chart. Dull streaks or low gloss, Thickness variation in machine direction (Surging), Dark specks, dark streaks, discoloration, Gels, Holes or bubbles, uneven coloring, Scuffs and scratches, Orange peel, Shark skin, Lines across the web(transverse direction),Flow lines, Die lines, Build up or scratches on die lips, Large or uneven rolling bank, Loss of contact between sheet and rolls, Uneven, quick quenching of sheet, Uneven, quick quenching of sheet, Moisture in polymer, Poor roll surface, polish roll not concentric, sheet lines in transverse direction ,.etc.

1.1.2. Multi characteristics:

In this process various rejections are occurring, it has relationship to other issues and given other following issues is identified by statistical process control chart. It has four types; we have taken two defects such as parabolic sheet lines and surface defects to solve it.

1. Sheet Lines in Transverse Direction: Extruder surging, "Chatter" marks, Pull roll chatter, Sheet sticking to roll stack.
2. Parabolic Sheet Lines: Unstable bank, Poor flow of polymer through the die, Bank forming at second nip point, Contamination.
3. Surface Defects: Low gloss recommended temperatures, uneven surface gloss, Loss of gloss on one side first nip to allow contact at second nip,spotted surface, Rough surface (sharkskin),Extruder surging.
4. High Sheet Orientation: Sheet thickness draw-down.

2. BACKGROUND

In this industry extrusion process has been carried out fully it has two units in Chennai. Injection moulding and extrusion process industry our project is carried out in extrusion area. They are manufacturing automobile plastic components like car showcase, side bedding, etc. and also manufactured washing machine items etc... in this industry work pressure is more, so they are not following proper quality management process, and the rework and rejection of quality issues percentage also increases enormously.Based on the process we selected the suitable tools, for following continuous improvement of a process it give more effective of an organisation.The production team and maintenance team are trying to reduce the part operation in a single machining operation, and then the quality issues are raised. They are facing many quality issues simply they are moving to recycle the affected job.

Since we request to know about TQM successful implementation, will minimize are eliminate our quality issues and then systematic approach will be carried out.

3. TOOLS AND TECHNIQUES

Implementation of TQM is the gradually increases the quality percentage and its reduce the quality issues at a minimal level, generally this tools are traditional tools many of the tools are used for an long term process and flow chart is used for shown exactly all the process are improved step by step continuously.

TQM tools are simple to use and its give employs training to us, such as statistical process control that are required specialist training can be used to measure variation and to indicate causes, some variations are tolerated in the output process

4. IMPLEMENTATION OF TQM PROCESS

While study the present scenario of the current situation of an industry some of the major issues are identified by applying TQM tools , in that seven tools techniques is used to identify the quality issues some of the preliminary test are taken to identify the issues affected in the available machines such as six Extruders and two Ultrasonic welding machines.

Table.1 Machine vise rejection.

USW M/C-1	REJECTION	471
USW M/C-2	REJECTION	414

EXT-MACHINE-1	REJECTION	2774
EXT-MACHINE-2	REJECTION	2922
EXT-MACHINE-3	REJECTION	2788
EXT-MACHINE-4	REJECTION	3153
EXT-MACHINE-5	REJECTION	3947
EXT-MACHINE-6	REJECTION	4594

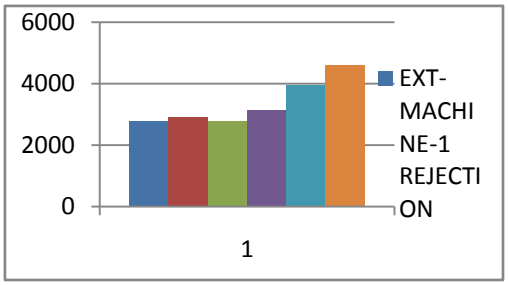

Fig.1.a.bar chart Percentage of rejection

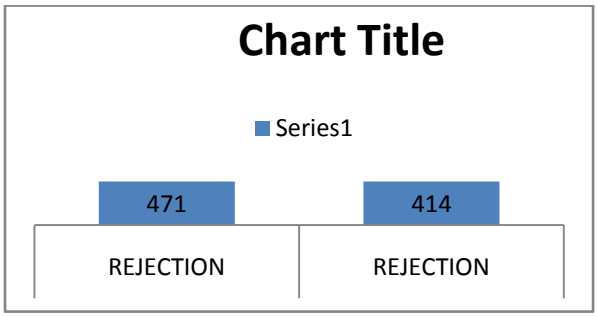

Fig.1.b.bar chart Percentage.

In this process machine vice rejection has been calculated for encountering the issues percentage is high and then giving priority to control machine vice issues make easy and flexible to minimize issues.

In this first priority is given for Extruder-6, because it causing more rejection percentage, then second priority Extruder-5, Extruder-4, Extruder-2, Extruder-3, Extruder-1 step by step cause of rejection could be identified and controlled.

5. OVERALL JOB VICE REJECTION

Since in this method we use statistical process control (SPC) chart for find out various types of issues are involved in a manufacturing line. While applying this technique percentage of the issues has been calculated with overall production rate and the issues are shown in fig. bar chart.

Steps involved in statistical process control chart (SPC)**:**

A few processes have been taken for bulk of the scrap or rework cost percentage calculated.

Step by step of continuous implementation of this technique find out multiple issues occurred.

Day by data overall production rate and rejection, rework rate will be taken and studied to implement proper quality management tools.

Table .2 above 1000 rejection

Holes/Bubbles	1649
Surface defects	1442
Spotted surface	1308
Extruder surging	1088
Shark skin	1514
Flow lines	1568

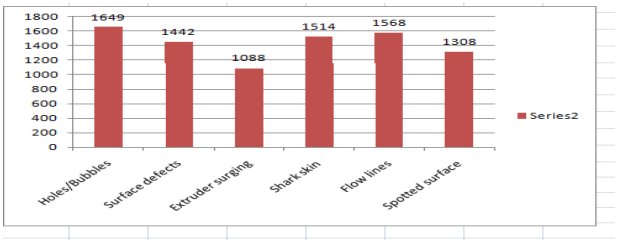

Fig.2bar chart

Table.3 above 800-1000 rejection

Thickness variation	817
Scratches on die lips	925
Winder tension	818
Rough surface	898
Orange peel	849

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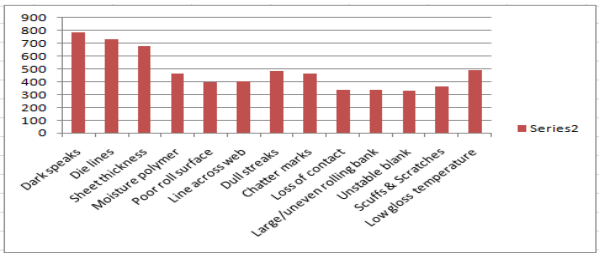

Fig.3 bar chart.

Table.4 above 300-800

Dark speaks	787
Die lines	730
Sheet thickness	681
Moisture polymer	464
Poor roll surface	393
Line across web	406
Dull streaks	486
Chatter marks	466
Loss of contact	337
Large/uneven rolling bank	337
Unstable blank	328
Scuffs & Scratches	361
Low gloss temperature	491

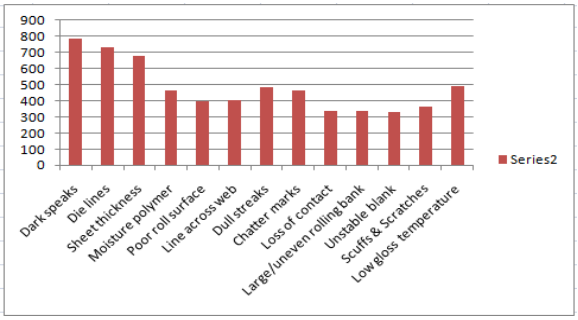

Fig.4 bar chart.

5.1. Single characteristics (doesn't have any relation to other issues)

It has only one type of issues, ***For example:*** one problem, one solution.

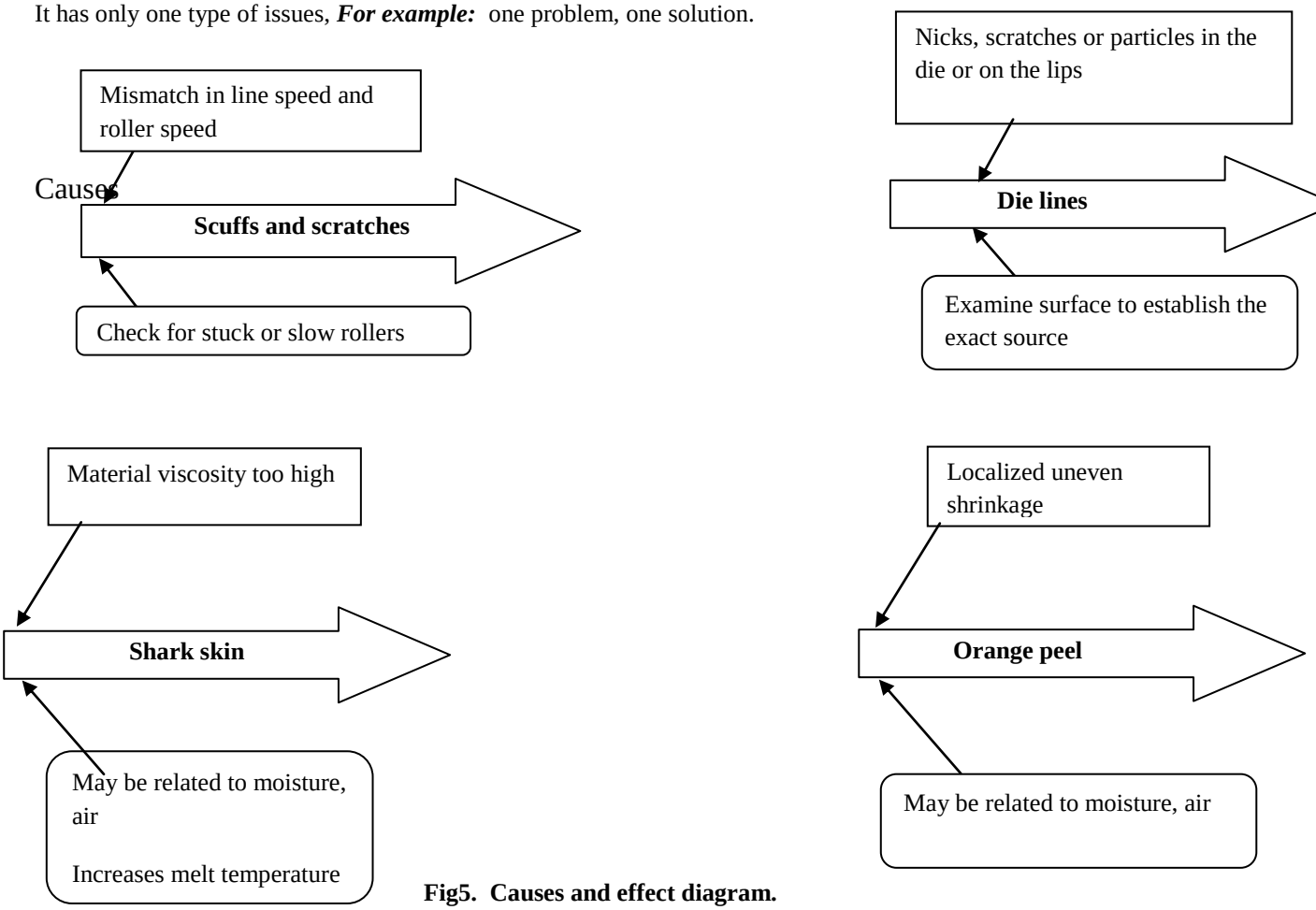

Fig5. Causes and effect diagram.

5.2 Multi characteristics issues:
It has relationship with other issues; it does not go with a single type of issues

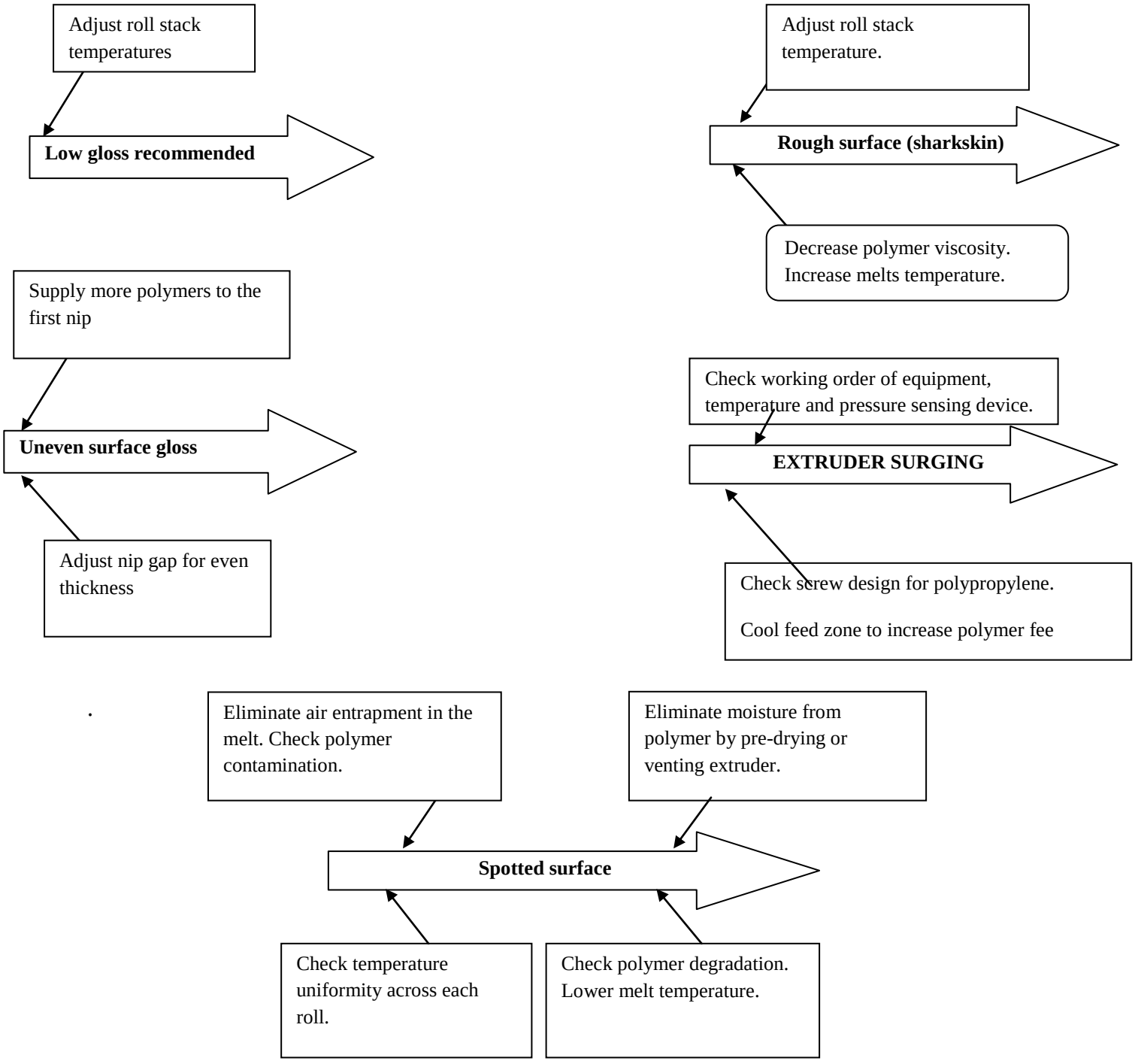

Fig6. Causes and effect diagram

6. STAGES OF ISSUES RECTIFIED

A. Above 1000 (Critical issues)b. above 800-1000 (moving to critical issues)c. above 300-800 (medium issues).

6.1. Above 1000 (Critical issues): These types of issues are critical issues, since it occurs due to the operational sequence has been reduced in an single machine of a operation, then the proper Quality management tools could not been followed. Due to lot of work pressure they are not take care about the issues, simply moving to rework same cycle has been gone through and hence need not to maintain the machine properly then after applying quality management tools step by step issues are controlled beyond at an minimal level.

Table.5 Above 1000 (Critical issues)

Holes/Bubbles	**320**
Surface defects	**282**
Extruder surging	**410**
Shark skin	**332**
Flow lines	**365**
Spotted surface	**322**

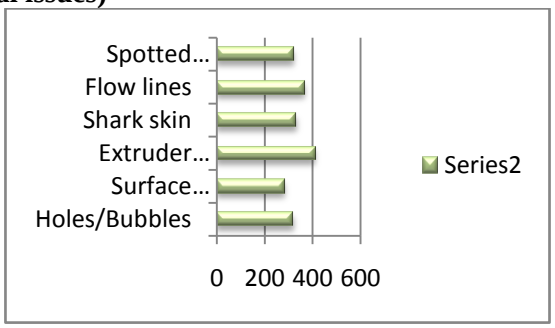

Fig.5 bar chart

6.2 Above 800-1000(Moving to Critical issues):

These types of issues are moving to critical issues, since they did not worry about the rework or rejection issues because they recycle and used it. This type of methodology is taking waste of time, waste of power, waste of source, waste of inventory, waste of money, etc., These types of issues has been easily controlled by quality management tools

Table.6.above 800-1000

Scratches on die lips	195
Thickness variation	200
Winder tension	141
Rough surface	182
Orange peel	132

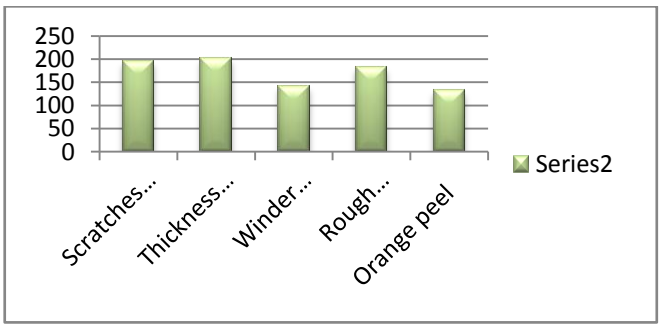

Fig.6. bar chart.

6.3 Above300-800 (Medium issues):

These types of issues are average issues step by step it increases and decreases the percentage of the rejection issues. In this paper lot of ideas has been implemented successfully by applied brainstorming technique group of person are giving more number of ideas for a particular issues it's recorded by a tape. Hence

Brainstorming technique and causes and effect diagram, PDCA cycle those techniques are shown current situations and implementing TQM concepts easily.

Table.7above 300-800

Dark speaks	210
Die lines	207
Sheet thickness	132
Moisture polymer	74
Poor roll surface	90
Line across web	96
Dull streaks	85
Chatter marks	72
Loss of contact	64
Large/uneven rolling bank	44
Unstable blank	31
Scuffs & Scratches	105
Low gloss temperature	120

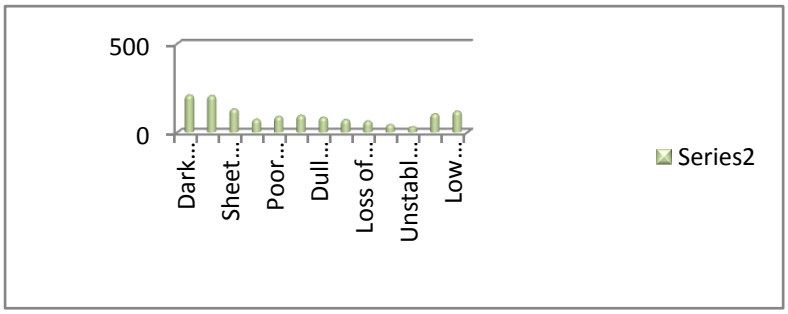

Fig.7bar chart

7. RESULT AND DISCUSSION

This study is to help about the TQM implementation and how it's effective in a plastic industry? Till now more number of organizations is lagging to implement TQM concepts and they didn't carry out properly. This tool gives standard level to the organization and its challenging to other organisation, its Identifies internal and external issues of the organization and gives exact solution. Finally, available TQM tools are used and suitable tools are properly implemented and a successful process is achieved. Same process will be maintained and it gives exact way of continuous improvement.

If we eliminate unnecessary waste rejection; rework; we can save our energy consumptions like man source, water source, money and time.

Obstacles faced when implementing

Human resource, improper communication, achieves operational sequence at a single machine, improper maintenance.

Implementing concepts successfully

Continuous improvement, effective and implementation, Better teamwork, Proper training & awareness, systematic approach.In this paper the application of total quality management tools is implemented. And an Overall quality issue has been controlled. I.e. Extruder -1-6machines (extrusion process) Ultrasonic welding machine {14}.

8. CONCLUSION

Now day's efforts of manufacturing industries are improved continuously in a quality operation due to customer expectation developing technology, and many other reasons they are moving TQM implementation. This gives best result of an organisation selecting suitable tools is necessary to avoid more obstacles. Since implementation of TQM need much more patience to wait, because it takes more time consumption process and this implementation takes go under right destination {14}. In this paper shown various implementation of Preliminary test should been taken to identify and rectify issues. Machines were studied, based on the data collected it was found that the amount of rejection was high in six extruders and two ultrasonic welding machines has been controlled at a minimal level. Before implementing TQM tools the rejection percentage is around 12.40%. After that using TQM tools such as PDCA cycle, brainstorming the causes of rejection and cause and effect diagram the rejection percentage is decreased to 1.13%.

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