THE STUDY AND IMPROVEMENT IN BLOWN FILM PROBLEM IN TUBING MACHINE

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ABSTRACT
The purpose of this paper is to discover and Improvement of plastic film related problem in Tubing machine of plastic film manufacturing industry. This paper also aims to develop the manufacturing process as fast as we imagine along eliminate the scrap and down time including less man power. This study focuses on to solve gauge variation in plastic film and stop this problem at the moment when it occurs by using different techniques and tools. The findings also investigate the effect of solution practices on plastic film performance/firm performance. This study covers some of the most common blown film problems and their probable solutions. It is hoped that the information contained here will be of assistance to you in your film operations. The goal of this paper is to describe specific defects that can appear in tubular blown film and to suggest probable causes and solutions. However, a research of the process of blown film extrusion is worthwhile. An operator can become so familiar with a given film line that problems are solved intuitively, but training new personnel or bringing a new line on stream may raise difficulties. Although we worked on main problem which is misalignment and completely solved.

INTRODUCTION
In today’s competitive marketplace, manufacturers of products and packages are under increasing pressure to satisfy varied and often conflicting demands, such as lowering costs, improving performance and enhancing environmental attributes. Within this arena, the material that a manufacturer chooses to use in its products and packages can affect its ability to remain competitive. Today in this world every task has been made faster & quicker due to technology advancement but this advancement is also demand large investments, every industry wants to make high productivity rate, maintaining the quality and standard of the product at low cost, but some of the problems related to quality that is still exist in product to slow down the production rate and increasing rejection. There are some problems occurs correlated of gauge variation as well as roughness while manufacture the blown film. This problem occurs due to some technical and human error that is creating production lost and scrap as well. So much time wasted to remanufacture the same product as per customer requirement that was we observed in industry, so we found all problem definitions related to
Blown Film Problem in Tubing Machine. After observing in machine the gauge variation and scrape is more producing due to roller misalignment, which is found to be the major problem in tubing machine. According to the misalignment the roller winds film in irregular direction and produces lot of scrap and increases waste of time to re-arrange the film to get proper align from both side manually by workers, and which is time consuming method as well as production is lost. Now this research tells that how to stop misalignment problem in film winding by putting only one simple mechanism which works on the bases of double acting cylinder and one external unit is used which will operate this mechanism automatically although this external unit is not the part of our field due to it has sensor and electric motor but it much helped to run this mechanism automatically. This external unit can be buy through third party because it is fully readymade and have combine features such as pneumatic and hydraulic. The main benefit of this mechanism is that has only 40 kg weight and can easily displace on the machine where you want. Block diagram of machine is shown in figure.

Figure-1 Existing Process of Blown Film

METHODOLOGY

1. first of all, read the research paper which is of this type of gauge variation related problem and study hard to understand process start to end of blown film. Then watch practically this process in industry and observe all machine activity and its process whole day.

2. Diagnose all problem definition which are the cause of lot of scrape and gauge variation of plastic film.

3. Decide whether which is the common and bigger cause and then study properly also collect the all data related to production such as rate of production, loss of production, productivity etc. And this could be done before putting mechanism.

4. Now start to do work on particular problem, here we had taken a misalignment problem which is a major to cause gauge variation of film and lot of scrape wastage.
5. Now start to do concept design of such problem, here we design one automatic mechanism which is fully automatic and economic too. Fig shows the mechanism that designed by us and accepted by industry however we didn’t work on external unit which makes it run and this unit is sold readymade by third party.

![Figure-2 Sliding Mechanism](image)

6. Now make sure to not do mistake in material selection for the process of fabrication to make this mechanism. As per the application of this mechanism we decided to choose mild steel for whole mechanism and roller material is aluminum for fast rotation as aluminum is light in weight.

7. Here we made a mechanism for the film length up to 1.3 meter so it cannot be used beyond this limit of length of film so for this reason double acting cylinder must have used moderate type of oil such as ISO 32 oil, although this mechanism is only used for sliding purpose. so grade 32 oil has good pour and flash point such as less than 210. its appearance is clear and white and its viscosity at 40 degrees Celsius is only 32.

8. Now find the position where the mechanism is suitable to get better alignment of film. we have found to fitted best before roller and also did some testing to put in between at different length from collapsing frame to winder. As per our analysis result we found that 80 microns gauge film has slow winding speed so it misaligns after collapsing frame so this mechanism need to be fitted after collapsing frame and usually this 10 to 60 microns gauge has gauge variation and misalignment occurs before winder so mechanism need to be fitted before winder. We made a block diagram which shows you exactly idea regarding mechanism location.

![Figure-3 Modified process of blown film](image)
9. Now take a trial of this newly developed mechanism on machine to do check whether its performance and make an analysis report of its effect on production and to check variations of without and after modification of machine.

WORKING OF MECHANISM

In blown film tubing machine when the idler roller vibrates and film moves or slides little from its original position then the air sensor attached at the one end of the film detects the break in flow of air. As occurrence of this deflection the diaphragm unit (external automatic unit) which has 4 pipes, first two pipes connected to the air sensors which circulates air due to motor connected to the diaphragm unit and motor has fan inside which blows the air to air sensor through the pipes and at a time external unit pumps the hydraulic oil to the double acting cylinder according to the displacement or misalignment occurs in film, after that piston rod of cylinder reciprocates in some distance in order to give required alignment of film, the tip piston rod is tightly joint with upper body at some extent or it can joint by nut and bolts, as per the reciprocation of DAC the upper part of mechanism which has roller is putting film to its original position by sliding on base plate while wind up. This process is continuously repeated whenever misalignment occurs, and prevent the gauge variation and scrape as well.

ANALYSIS REPORT

The following graph shows the difference in production data per day.

A. Efficiency
Efficiency of machine is going to slightly low after attach additional mechanism before film rolling winder. Usually its maximum efficiency is 95% and it may be decrease slightly to come back 92 to 93 due to extra work and energy used by mechanism.
B. Production time

Production time can be calculated by adding industrial activities which consume time for each operation such as process time, inspection time, wastage time, loading and unloading time etc. so the sum of this time gives the production time of one unit or time for total unit per day. Here as per our observation we calculated the specific time for one unit before applying mechanism and after putting mechanism and there is a lot of difference have been seen in production time.

- Delay time
  
  We observed that the worker wasted 10 to 15 minutes to adjust every misalignment of film, as he taking time to adjust film by manually (by hand). We also observed that every misalignment is happened in every 45 or 50 minutes. So, worker or operator has to keep their eyes in winder in order to see misalignment and instantly do the align.

BEFORE

Production time = Process time + inspection time + product move time + wastage time + scrap removing time

= 50 min + 5 min + 5 min + 15 min + 15 min
= 90 min/1 unit

Note: Here 15 minutes are wasting in misalignment of film edges by worker and sometime it also takes more time due to cutting the film by mistake during production of one film roll.

AFTER

Production time = process time + inspection time + move time

= 50+5+5
= 60 min/1 unit

As we can see that after mechanism, wastage and scrape removing time is eliminated so one unit is produced in only 1 hour (60 min).

We also observe that if sizer is going to change after sometimes at a time delay period of machine is lost the production and if this mechanism is fitted then the situation to change sizer can be extending due to no defect in film and smooth operation.

C. Productivity

1 day = 24 hours = 1440 minutes

15 minutes wasted by worker during every hour of production to adjust misalignment manually, so multiply 15 minutes 24 times then it will become 360 minutes per day.

Total 360 minutes wasted in actual production.

Now, 1440 – 360 = 1080 minutes (productive work time)

BEFORE

PRODUCTIVITY (%) = PRODUCTIVE WORK TIME / ACTUAL TIME
= 1080 / 1440
= 0.75 = 75%

AFTER
Mechanism eliminate the wastage time but some unexpected maintenance consumed sometime 40 minutes per day, so we have to count.
Now, 1440 – 40 = 1400
PRODUCTIVITY (%) = PRODUCTIVE WORK TIME / ACTUAL TIME
= 1400 / 1440
= 0.97 = 97%
Note: all wastage is eliminated after put mechanism and obtain excellent productivity.

D. Production Rate
We obtain major difference in rate of production while analysis. Production rate for one particular product can be derive by formula which is as follows.
Production rate = produced unit / production hour of produced unit
We derived that the film having thick gauge has less revolution of wind up and other side thin gauge has more revolution of wind up.

BEFORE
1080 minutes = 18 hours
produced unit per day = 24 unit
Production rate = produced unit / production hour of produced unit
= 24/18 = 1.33 = 1 items produced per hour.

AFTER
produced unit per day = 46
1400 minutes = 23.33 hours
Production rate = produced unit / production hour of produced unit
= 46 / 23.33 = 1.97 = 1 items produced per hour

E. Scrape wastage
As we observed that time of sizer change, we got more scrape and that things decrease after mechanism fitted.
This also stopped the need of special operator near machine and that is beneficial for organisation to reduce the cost of special operator.
We derived from the observation that 1 to 1 and half kg of scrap reduced per day after the putting mechanism.

BEFORE
Defects and scrape = 0.012 = 12 % per day

AFTER
Defects and scrape = 0.04 = 4 % per day

RESULT

This is the real analysis report that we taking from running condition of machine in plastic film making industry. From this analysis report, we can see that obtained result is quite good and also lot of differences can see after modification. Some photos taken by us which shows solved the issue.

FUTURE SCOPE

Many problems occur in blown film extrusion in the hot melt between the die and the frost line and where the tube is collapsed at the main nip. From the literature study and definition of problem, we have seen according to the plastic raw material and its property as well as misalignment of film at winder, air ring and impurities stuck in air ring, film gauge variation occurs due to quality of material, dirty air ring and poor die and air ring adjustment etc.

We just did work on misalignment problem and solve it by making extra mechanism but still lot of problems is there pertaining to die and air ring which is responsible for scrape and gauge variation of plastic film.

CONCLUSION

We conclude from the analysis that after mechanism misalignment as well as wastage time of worker can be completely reduced and this is specially more advantageous to industry. Above analysis, theory shows lot of difference in before and after modification and as per this it is advisable to put mechanism for better defect free product with less or no maintenance.
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