Study on Improvement of Productivity at Wire Rod Mill

In a wire rod mill, the performance in term of rolled output plays a vital role in the bottom line of the organisation. In the rolling system, raw material (in block form) is fed one after one, after adequate heating. Then the heated material is drawn by a series of roller and the output is collected through a conveyor, in a coil form. The whole system runs continuously. In order to have trouble free working, the entire coil should be perfect round coil. A concave deformation at a small portion of the ring is called KINK and when it forms, the wire rod refuses to pass through the conveyor. It was observed that the KINK formed in the last few coils only.

When KINK formed at the last coil, the movement of the conveyor halted resulting disturbances in the process. The next coil in process has to be cobbled since the conveyor stopped and occupied. This results in huge loss in terms of fuel power and time of the conveyor. The loss estimated during 1998 is Rs. 60 Lakhs.

In order to run the process satisfactorily it is necessary to control the speed (rod inertia), of last delivery roller (#27) after it releases from earlier roller (PR). This is carried out by introducing another set of roller called pinch roller just before the delivery roller. The pinch roller starts acting after the rod is released from PR center. The distance between the last roller center (#27) to PR center is 12.746 mt. The speed of the rod is 70mt/sec. Total time available to control the rod inertia is 182 millisecond, which equals to 3.86 rings.

As per control specification at least 4 to 5 rings needs to be controlled. The time required for the system to react for step down is 140 millisecond. Therefore, 42 millisecond is available for effective control, which is equivalent to 2.94 mt. i.e., less than one ring. This results in ineffective reduction of inertia, which creates the KINK Formation.

Process is mapped into three main function i.e. Rod Tail sense, PLC to DRIVE and Drive to Motor. The motor act on Punch roller for controlling the rod inertia. A software programme is written to measure the time for different actions and process flow is measured with respect to time. The average time found that the three functions take 20, 50 & 60 millisecond respectively. Moreover, the variation of PLC to DRIVE is quite high i.e. from 20 to 150 milliseconds. This is later verified technically and found this variation is in built.

It was then suggested to directly control the pinch roller, as the function of PLC to Drive is required for other controls. This reduces the time requirement of the system to act on Pinch roller (130 to 80 milliseconds). Hence, it is now possible to control the rod inertia effectively resulting in elimination of KINK problem.

Improvement of Process Performance through experimental design

The multinational chemical company manufactures a surfactant called L255. It is an intermediate product and is subsequently used for the production of an important dispersing agent for pesticides. The company was facing some problems with the quality of L255 batches manufactured over the recent past. There were a number of rejections in the first-time test with respect to a quality characteristic called wetting time necessitating frequent readjustments and occasional rejections of batches. This leads to considerable loss of resources for the company.

Wetting time measures the dispensability of the substance in the base material. The specifications require the wetting time to be less than 15 seconds. The mean and standard deviation of wetting time values of 50 batches made in the previous year were 14.56 and 2.37 seconds respectively, which indicates an expected non-conformance of about 42%.

From technical discussion, factors are identified and data form logbook is collected. From the analysis, it was observed that Effective agent (EA) has contribution on the product performance. Digestion time of the reaction was also expected to have some effect on the wetting time, from technical consideration.

The exact chemistry behind the behavior of surfactants is not always known to the industry, because the usually short life cycle does not permit major investments for product research. In the case of L255, how the selected factors influencing the wetting time were not known explicitly. A full factorial experimentation was conducted by involving the two factors.

Carrying out a trial at manufacturing area involves rejection of the batch. Hence, it is decided to carry out the trial in the laboratory to study the effect.

Experimentation revealed that both the factor contributing significantly on wetting. Orthogonal polynomial regression equation fitted on response data to find out the optimum contribution. Optimum combination was found and confirmatory trial at regular production was taken. The results of confirmatory trial are very much encouraging. The wetting value is 11 seconds. The changes in process parameters were implemented. Data were collected from next 20 batches and not a single batch is rejected/readjusted.

Application of OA experiments for development of amino resin

The department is engaged in development activities. In order to develop amino resin, a project was taken up to identify from among several factors affecting the processing of amino resin, dominant factors and their preferred levels. Process of development of amino resin and it's chemical reaction was studied. 7 factors with 2 levels each are selected for experimentation. An OA Experiment of $L_8(2^7)$ is chosen to carry out the experiment. Experiment is carried out in controlled condition at 2.5-liter reaction vessel. During each trial 7 responses are recorded.

Analysis of variance is carried out for the all the responses. Dominant factor with desired level was found for all the responses. Discussing with the development engineer, the important factors and their preferred values are selected. Confirmatory trials are taken and the results prove that experimentation based on statistical theory optimize the effort to develop a product. This study highlights the uses of OA experiment in developing a new product.

Improvement and Control of Employee performance through Employee Survey

Performance appraisal system is the activity many companies does and keeps records. But absence of appropriate mechanism to analyse the data and action based on that makes the system ineffective. Study was taken up to develop the system by which employee's performance will be

- Objectively decided
- analyse to assess capability, identify opportunities for improvement
- improve continually with respect to overall human resource perspective.

After studying the existing system , new system is proposed for appraisal. Data are of verbal and in rating scale. Data collected and analysed. Opportunity for improvement are established and action plan is made.

Determination of Optimum parameter levels and tolerances for Capacitors

A company manufacturing capacitors used for power equipments has planned to go in for capacitors of higher rating upto 250 KVR. The capacitors currently manufactured have capacitance range from 3 to 15 Macro-Farads. The present variation in the capacitance value of capacitors is ± 4.2% of target value
The management wanted to examine the feasibility of reducing this variation to ± 1%. The process of manufacture was studied and it was found to be experimental problem. 5 experimental factors were identified and their variation was identified as noise factor. Parameter design was constructed and experiment was carried out. The result was analysed and optimum combination determined. After implementation the capacitors variation was reduced to ± 1%.