Prevention of corrosion in pulp and paper industry-Mysore paper mills experience

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ABSTRACT

Prevention of corrosion in pulp and paper Industry is achieved right from the concept stage of the industry itself and to be taken care of in engineering and later to be incorporated in plant and machinery selection and then in detailed engineering. The paper brings out the experiences of Mysore Paper Mills indicating how the mill is trying to reduce the impact of corrosion by systematic analysis and changes.

INTRODUCTION :

The selection of basic processes should be made after indepth study of all available processes with respect to corrosion in addition to the normal evaluation of economics and adapatability. This is to be taken care of in the concept stage. It is to be noted that identification of the correct and appropriate concept, in the initial stage itself, will lessen the problems associated with corrosion.

The engineering stage plays a very crucial role in minimising the corrosion problems in the industry. Layout of the plant with respect to wind direction can be a major cause for corrosion and it is found in some of the Mills, this causes severe damages to steel and structures. The sizing of individual plant areas are to be such that good ventilation is available for fresh air and natural exhaust takes care of corrosive atmosphere.

Prior to selection of plant and machinery, an indepth study is to be made for the possible corrosive effects. This will prevent recurring problems due to corrosion by failures and breakdowns of plant and machinery. Here, it needs to be emphasized that unwarranted costly material of construction need not only be the solution and a balance has to be struck between the cost and the life of the equipment. Bleach section is an area where materials of construction have to be selected carefully to give the necessary economic advantage.

2. EXPERIENCE AT MYSORE PAPER MILL :

Mysore Paper Mill's layout of chlorine handling and hypo preparation plant take in to account the wind direction over the year and its location avoids totally the corrosion effects on all other plants. The engineering of kraft mill have taken care of the ventillation aspect and does not require any artificial system to bleed of corrosive gases. Incase of pulping of bagasse MPM conceptualised a scheme by which bagasse is wholly conveyed right from sugar mill up to wet storage yard avoiding transportation and intermediate storage, which would have increased corrosion and erosion problems. Further the complete reuse of back water of bagasse wet bulk storage yard was envisaged so that corrosion due to this low pH liquid (pH~2.5) on effluent treatment equipment is avoided. The plant is envisaging for oxygen bleaching of chemical pulp eliminating the existing corrosive chlorine system.

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Lot of care has been taken in selecting suitable materials of construction on economic criteria. For example, for handling hypo hastelloy C pumps are used which are very expensive compared to its service life than, say, rubber lined pumps. However, for most pulp mill equipments particularly in the bleach plant, SS-304 materials are used and in some specific locations, SS 316/SS 317 are used. where erosion problems are encountered. As a typical example, B.S. washers have SS 316 wire cloth. In future, MPM may go in for synthetic wire cloth for chlorine washer as this may have cost advantage over SS 317. The Vats of bleach washers and tankages are tile lined which is found economical when compared to SS materials. Cast iron castings of pumps are found to be economical even in bleach section compared to SS castings. However where erosion/corrosion phenomena occurs, it is found that only SS & sometimes high nickel cast iron are found to be more withstanding.

In the pulp cleaning section, the inlet chamber and the reject chamber are prone for more corrosion/erosion problems, particularly when the cleaners are handling bleached pulp. Installing cleaners at bleach section is to be avoided. The usage of ceramic and polyamide materials will enhance the life of wearing out parts. In recent times, it is found due to technological improvements that SS rolls can replace phosphor-bronze rolls or copper coated rolls, which are also more resistant to corrosion and wear. The hood and the exhaust system should have corrosion resistant materials. The lubricant in paper machine particularly in wet end should have water repellant agent to prevent emulsification and subsequent damages to bearings of equipments. These are few salient points and indepth evaluation is to be carried out for corrosion prevention on these lines.

In corrosive atmosphere, denser concrete mix is to be planned in addition to preventive coatings. The structures and tankages should heve adequate corrosion allowance. The material of construction of pipes and valves should be selected considering a minimum life of 10 to 12 years. However, it is to be stated here that unwarranted use of SS materials may not always be the solution. In material handling equipments, the material of construction plays a vital role as it may lead to down times which are costly It is found that FRP pipelines (if properly specified) are less problematic compared to lead and PVC lines for hypo handling. For pipes which are to be joined by welding and which are to handle low pH corrosive media like pulp during bleaching sequence, SS 316L/317L are found to be useful. For chlorination CS pipe with rubber lining proves to be better. For other bleached stocks, SS 304L is sufficient. All tower inserts should be of SS material and for chlorine towers FRP coating/rubber lining is a must, The pulp mill washer area structures should be epoxy coated. The bagasse handling area structures are to have minimum "Chlorinated Painting" for moist handling and for wet handling, epoxy painting shall be used and the sheets and chutes are to be of SS material. Conveyor idlers in corrosive atmosphere are preferable to have fully sealed or nylon sleeve bearings, The handling of bagasse in wet form & alum etc., in liquid form should be minimised to reduce corrosion effects. It is found that by taking proper care in the engineering stage, most of the problems of corrosion can be eliminated.

3. FEW CASE STUDIES OF PLANT MODIFICATIONS FOR REDUCTION / ELIMINATION OF CORROSION :

(a) Bagasse yard : Originally, the plant had gone into asphalt top for wet bulk storage of bagasse due to economy. It was found that this cannot with stand the high corrosiveness and failed due to impact of earth moving equipments. Concreting was done over which coal tar epxy was applied and this is found to be successful.

(b) Digester Screw Feeder : The screw life was enhanced by using stellite (cobalt alloys) from 400 hours to 1200 hours. Further, the blow back valve adapter plate bolts (SS 304) were getting out due to residual chlorine effect and this was overcome by using CS bolts.

(c) Chlorine pipe lines : After installing proper dryers for air for the air padding arrangement, it is found that there was no problems of corrosion,

(d) Hypo Handling Pumps : It is found that without chilling plant, it is not possible to maintain the temperature of reaction below 40°C and due to this, the rubber lining does not last long. Efforts are on way to put chilling plant in service.

(e) Corrosion of ducts in recovery : It was found that moisture entry into the duct between the casing and insulation was causing heavy localised corrosion. This increased the air ingress into the system. thus affecting the performance of ESP. The whole ducts were renewed and the ESP revamped. Roof shelter were provided for ducts andESP to avoid water seepage. A by-pass duct for cascade was provided to maintain the temperature of ESP.

f) Knotters : Initially screen plates of SS 304 were used and were found to be cracking due to the phenomenon of "stress corrosion cracking". Screen plate was changed to carbon steel and the problem is now eliminated.

4. NEED FOR AWARENESS & TRAINING :

The equipments structures prone for corrosion are to be indentified, proper coating/prevention measures laid down, periodical inspection carried out and improvements in prevention methods are to be incorporated. This is a continuous process. Training of personnel is to be imparted in the mill site by experts on corrosion so that the adequate exposure and knowledge is gained for utilising on corrosion control.

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