Waste Paper Recycling - An Approach to Sustainability

Prof. Bhojraj N. Kale[1], Aditya Guhe[2], Ghanshyam S. Bodkhe[3], Vishal Kuril[4], Pranav Waghmare[5]
[1, 2, 3, 4, 5] Department of Mechanical Engineering
[1, 2, 3, 4, 5] DBACER, Nagpur – 441110

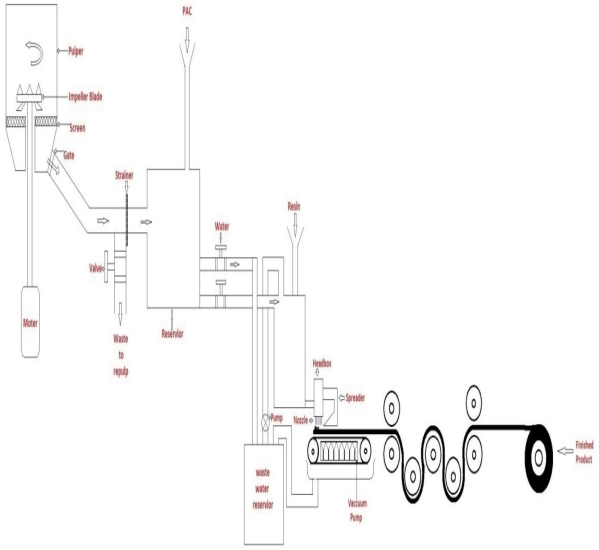
Abstract- *Concept of the proposed project work is to recycle the used waste paper to convert it into useful paper. In any big institution, especially educational institutions like schools or colleges, generation of large quantity of waste papers is quite apparent and effective use of recycled paper is also possible (craft papers, registers etc). So, instead of disposing off the waste papers into trash, recycling them makes sense. This not only helps the institute in cost saving but will also ensure its contribution towards the protection of the environment. The proposed model design is small-scaled paper recycling plant, which can be used in schools and colleges, ensures that a cheap and non-complex method of production of paper product is guaranteed. The unit will be prepared with all necessary component specifications taking safety in consideration.*

Keywords- Waste Paper, Recycle, Economic, Environment

I. INTRODUCTION

Paper is one of the most important products ever invented by man. Widespread use of a written language would not have been possible without some cheap and practical material to write on. The invention of paper means that more people would be educated because more books would be printed and distributed. Industry would grow because all the plans, blueprints, records and formulae it uses would be written down and saved, together with the printing press, paper provided an extremely important way to communicate knowledge. The most of the paper are made up from the wood. So this is major and very crucial factor for the environmental conditions. Therefore we need to recycle the paper and hence we are studying and working on the fabrication of small scale set up of waste paper recycling unit. This process includes mixing of waste paper with water and chemicals. This process is widely used in industry which uses different waste paper, ex cardboards, newspaper and notebook paper for recycling. The other part is related to chemicals which needs for the formation of good pulp and paper. In these project to maintain quality of paper is major factor on which further applications are depend. These techniques used in industry in large scale we need to implement these techniques in small scale as in college lab and workshop level because most of the waste is from colleges and schools.

II. DESIGN



III. PARTS OF UNIT

1. Pulper / Mixer

The main purpose of the pulper is to crush the recycled paper into the pulp. This pulper/mixer consists of the vessel in which the cutter is provided for cutting purpose. This cutting blade is mounted on the shaft of the motor. It has a volume of 1.5 lit. The pulper vessel cutter rotates at high speed nearly about 2800rpm.

2. Reservior tank

The reservoir tank is consists of polyethylene material, in which the pulp can be stored. There is no chemical reaction takes place inside the reservoir tank. The capacity of tank is 100lit. And it is having small opening of 8cm at the top surface.

3. Chemicals

The chemicals which are required for paper recycling are Poly- Aluminum Chloride (PAC), Resin, Bleaching

powder. Poly- Aluminum Chloride (PAC) is manufactured in both liquid and powder form. It is added into the pulp for sizing as well as whitening of the paper which can be formed. 0.4 ml of resin is added in 1 kg of the pulp where as 0.3 ml of PAC is also added in 1 kg of pulp for making the proper bonding of the paper. Resin is a sticky substance which is added into the pulp for making proper bond of the paper and Bleaching power is sometimes used in the pulp instead of PAC for whitening he paper.

4. Headbox

The purpose of the Headbox is to deliver a uniform pulp on the conveyor. The pulp is spreading on the conveyor with the help of gravity so, it is known as gravity fed headbox. It uses height/weight level difference to force the pulp through several baffles on to the conveyor. If faster production speeds are required the pulp must be fed under pressure. It is made up of sheet metal having thickness of 2mm.

Dimension - 14.5 x 8 x 8 inch

Material – M.S. sheet.

5. Conveyor

Conveyor is a component which rotates continuously and which is placed below the headbox. The rotation of the conveyor takes place by means of motor. The motor, whose speed is too high, is reduced by means of gearbox. This gear box is attached with the motor and the desired speed of the conveyor can be achieved easily.

6. Air Blower

The purpose of air blower is to suck water from the pulp, which is placed below the conveyor. The piping arrangement is provided for sucking water from the pulp. Impeller is provided inside the blower casing which create the pressure more the atmospheric pressure. The impeller is driven by the motor connected to it.

7. Hot Air Gun

The heat gun is device used to emit a steam of hot air usually at temperatures between 100-450deg. Celsius. It can be held by hand and usually have the form of an elongated body pointed at what is to be heated, with a handle fixed to at right angles and a trigger, in the same general layout as a hand gun, hence the name.

Specifications:

Table No. 1: Specifications of Heat Gun

Air flow	300lit/500lit/min.
Temperature	380-500deg. Celsius
Input power	1000/1600W
Rated voltage	220V
Rated frequency	50Hz

8. Roller

A cylinder that rotates about its central axis and is used in various machines and device to move, flatten, or spread something is a roller. It is made up of M.S. Round bar. The two rollers are attached in such a manner that the pulp can pass between the rollers and sheet of paper can be formed. The distance between the two roller can be set according to the desired thickness of paper sheet.

Material: M.S. Round Bar

Dimensions: 25mm x380mm

9. Motor with gearbox

An electric motor is an electrical that converts electrical energy into mechanical energy. The D.C. Motor with a speed of 960 rpm is connected to gear box. The output shaft of motor is connected to the input shaft of the gear box. Hence the speed reduction of the motor takes place. This arrangement of motor and gear box is designed for reducing the speed of conveyor (gear ratio is 15:1).

10. Coupling

Coupling are mechanical elements that couples two drive elements which enable motion to be transferred from one element to another. A jaw coupling is type of general purpose power transmission coupling that also can be used in motion control applications. It composes of three parts two metallic hubs and an elastomeric insert called an element, but commonly referred to as a spider.

11. Bearing

A pedestal bearing is used to provide support for rotating shat with helpn of various accessories. Housing material for pedestal bearing is typically made of cast iron or cast steel. Rollers are mounted with the help of these bearings. Two end shaft of roller are attached to the bearings to minimize the friction losses.

12. Frame

The experimental set up is rigidly mounted on the frame made up of rectangular cross section bars. The function of the frame is to provide stability to the components.

IV. WORKING

A. Pulp Formation

It is the process in which pulp is produced inside the pulper vessel. Inside the pulper vessel impeller rotates at high speed nearly about 2800rpm. When paper feed agenized the impeller it converted into small particles and mixed with water in this way pulp produced.

B. Screening

Screening is the process in which the unwanted particles which produces further difficulties in proper formation of paper are removed with the help of filter. Unwanted particles such as stapler pins, hard paper etc.

C. Bleaching

After screening the pulp is stored into the storage tank. Where in the storage tank the first additive is added name as PAC (Poly Aluminum Chloride) is added. This helps for maintaining the PH value of the pulp. After that before feeding the pulp on the conveyor this pulp is stored into the head box, where the rosin is added into it for increasing its bonding.

D. Rolling Paper Drying

As soon as pulp is feeded on the conveyor the process of extracting water from pulp is necessary for making a paper.

E. Paper Drying

After extracting water this paper is then passed through series of rollers in which the hot air is supplied. This helps for drying and increasing the BF (Bursting Factor) of the paper.

V. ADVANTAGES:

- Conserve natural resources.
- Saves landfill space.
- Protect and conserves our clean air.
- Saves energy.
- Reduce amount of waste.
- Reduce energy consumption.
- Preserving resources.
- Saves trees cutting.

VI. APPLICATION

- Recycle Waste Papers.
- Old Newspapers.
- Wastes Papers in Premises.
- Thrown Textbooks.
- Other Paper Waste.
- College practical file, Sheet & Destroyable paper.

ACKNOWLEGEMENT

We are sincerely thankful of Meghe Group of Institution (MGI, Nagpur) for permitting us to pursue this work and providing financial assistance for this project work. We are also thankful of Dr. V.H. Tatwawadi, Principle (DBACER), and Dr. S. V. Prayagi (HoD, ME, DBACER), for their support in all way.

REFERENCES

[1] Pulp and Paper Chemistry and Technology Volume 2, edited by Monica Ek, GöranGellerstedt, Gunnar Henriksson, De Gruyter Publications.

[2] Akshya Paper Recycling Mill located at Karanja (LAD), Maharashtra.

[3] Kenneth W.B., Handbook on Pulp and Paper Technology, Second Edition, Van Nostrand Reinhold Co., New York, 1970.

[4] Carlson W. E. C., Recycle Process Inc. USA, PCT/US 91/03084, May 6, 1991.

[5] Discussion Paper on Collection and Recycling of paper in India

[6] Recycling Machine by M. A. OLUTOYE

[7] Sinnot R.K., Coulsons and Richardson's Chemical Engineering, Vol. 6, Third Edition, 1994.