Design, Construction and Performance Test of an Industrial Power Generation System Using Dyeing Machine Exhaust Steam

A project report submitted to the department of Mechanical Engineering for the partial fulfillment of the degree of **'Bachelor of Science in Mechanical Engineering'**

Submitted by:

Md. Jihadur Rahman ID: BME1602009182

Md. Merajul Islam ID BME1602009180

Md. Reazul Islam ID: BME1602009181

Md. Kawsik Ahamed ID: BME1602009174

Supervised By:

Md. Ahatashamul Haque Khan Shuvo

Lecturer& Assistant Coordinator

Department of Mechanical Engineering

Dhaka, Bangladesh

February,2020

Acknowledgement

All praises and gratitude to almighty Allah for giving us the capability to undertake and complete this project for our study.

We express our gratitude, sincere appreciation and profound respect to the supervisor Md.Ahatashamul Haque Khan Shuvo for his valuable guidance, continuous advice, encouragement, contribution of new ideas and cordial assistance at all stages that enabled us to complete the work successfully. We are also grateful to our parents and fellow classmates to enhance our spirit and interest towards this topic by providing us enthusiastic encouragement.

In this project we have tried our best to achieve our goal. in early stages, many individuals have contributed towards this project to gather information and directions relative to our project.

We would like to render our gratitude and grateful thanks to each one of them.

Authors

Abstract

Power sector of Bangladesh is a challenging sector and development of power sector is dependent on many factors. In this project, a brief discussion on industrial power generation by using dyeing machine exhaust steam has demonstrated with recent information and data. A total review of industrial power generation, transmission and distribution is demonstrated and also power crisis of Bangladesh industrial sector and economic benefits waste heat recovery power has been discussed. In our project, we have tried to minimize the industrial power requirement by using exhausted steam which is use as a byproduct. Also including industrial power generation, transmission & distribution a details study on power plants of Bangladesh and power crisis of Bangladesh has been discussed

Letter of Transmittal

Date:

To

Lecturer
Department of Mechanical Engineering.
Sonargaon University (SU)

Subject: Submission of Project Report

Dear Sir,
We are hereby pleased to submit the report on **Design, Construction and Performance Test of an Industrial Power Generation System Using Dyeing Machine Exhaust Steam** .It has been great pleasure to work on such an important topic .we have completed the report according to Sonargaon university requirement and complying with your suggestion and comments.

We sincerely believe that you will find this paper very useful and informative. we will be happy to furnish you with further explanation that you may feel necessary in this regard

Sincerely yours,

Md. Jihadur Rahman
BME:1602009182

Md. Merajul Islam
BME1602009182

Md Reazul Islam
BME1602009180

Md kawsik Ahamed
BME1602009174

Declaration

We do hereby solemnly declare that the work presented in this report has been carried out by us under the supervision "Md. Ahatashamul Haque Khan Shuvo (Lecturer), Department of Mechanical Engineering Sonargaon University (SU)".

We have tried our best to make the report accurate with information and relevant data. We hereby ensure that, the work that has been presented dose not breach any existing copyright.

We further undertake to indemnify the university against any loss or damage arising from breach of the forgoing obligation.

Date:

Signature of Supervisor

(Lecturer) Department of Mechanical Engineering.

Sonargaon University (SU)

Table of Contents

Chapter 3 Methodology

Chapter 4 Result and Discussion

Chapter 5

List of figures

List of Tables

Chapter 1

Introduction

1.1 General

Bangladesh is a small developing country with limited indigenous energy resources. Per capita consumption of energy in Bangladesh is one of the lowest in the world. Present consumption of energy and electricity in the country is about 200 kg/year and 130 kwh/year respectively in which about 65% of its per capita energy is derived from biomass resources. In recognition of the importance of energy in socio-economic development, the government has given continuing attention to the overall development of the energy sector.

But up to now, it has not been possible to achieve reasonable success in meeting the growing demands and the gap between the projected demand and the supply serve is increasing day by day because of inadequacy of indigenous resources, improper planning, unreliable policies and decisions on the development of power sector. Like many other developing countries, Bangladesh is facing enormous challenges to provide affordable, reliable and equitable energy supply to its citizens.

About 25% of the population has only access to electricity. Consumption of energy and electricity in per capita terms is one of the lowest in the world. Noncommercial energy sources, such as wood, animal wastes, and crop residues, are estimated to account for 65% of the country's energy consumption. In recognition of the importance of energy in socio-economic development, the government of Bangladesh has formulated and approved the national energy policy (NEP) in which two different projections of energy and electricity were made covering the time horizon up 2020 aiming at sustainable development [1].

BPDB had also carried out twenty years “power system master plan” (PSMP) for the time horizon 1996. In 1996 the government issued the "private sector power generation policy of Bangladesh" and began to solicit proposals from international companies for independent power producers (IPPS). Several structural changes in the power sector were also made for accelerating the power sector development [2].
However, over the years, significant development in the power sector has not been realized. Moreover, the gap between the demand and the availability of supply of energy,

In particular, electricity has been increasing year in and year out. Presently, the shortages of electricity and commercial energy have become a persistent problem in the country.

In our project, we have tried to minimize the industrial power requirement by using exhausted steam which is use as a byproduct. Also including industrial power generation, transmission & distribution a details study on power plants of Bangladesh and power crisis of Bangladesh has been discussed.

Additionally, our objective is to provide a genuine power scenario of Bangladesh which will help to learn about power sector of Bangladesh thus it will be helpful for improvement of our power system.

1.2 Objectives:

The objectives of this project are:

a) To study about the power generation using exhaust gases of dying machine

b) To design and construct an industrial power generation system using dying machine exhaust gas

c) To analyze the performance of the system.

Chapter 2

Literature Review

2.1 Background

The need for improved energy efficiency by using waste steam & heat recycling in industries is unquestionable. Responsible for one third of global energy demand and set against the backdrop of increasing consumption and depleting energy-rich fossil-based fuels, it is likely that the future will bring increased energy prices and both short and long-term energy insecurities. This is not an ideal situation for industries and a response to this threat is urgently required.

For industries to reduce reliance on fossil-based fuels and at the same time reduce environmental impact of their activities there are two basic options: the use of renewable energy systems or the recovery by using waste heat recovery system. The incorporation of renewable energy technologies is an increasingly attractive option as prices fall but are not suitable for all locations and investment costs can still be prohibitive. The alternative, the recovery by using waste heat recovery system, can be divided into three further options: a reduction in total activity (better energy management and recovery and use of waste energy. A reduction in total activity can occur without detrimental impact on the profitability of a company but requires a significant change to the business model and is not suitable for all company types. Energy management has been explored at a number of manufacturing levels and has been shown to be suitable for long, medium and short-term energy consumption improvements. Energy recovery and use is founded on the principle that energy is never actually consumed; it is only converted from one form to another.

Andso, there is a potential to capture this and utilize it as an energy supply. This is best conceptualized when considering the lifecycle of energy within a plant (fig. 1), where energy (typically waste heat) can be recovered closed loop (reused back into the same process) or extended loop (recover into the energy supply of the facility). Recovered energy, in effect, replaces the need for a proportion of final energy demand by a facility.

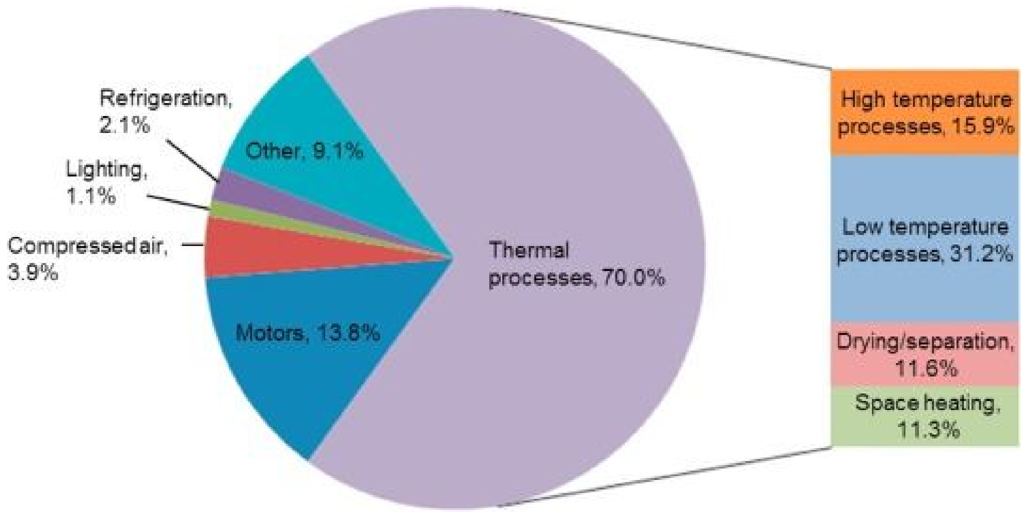

Fig. 2.1 Energy consumption industry by type and industrial strategy

2.2 Dyeing machine used in wet processing:

Dyeing or wet processing is one of the most important departments of textile industry. There are so many dyeing machines are used to dye the fiber, yam or fabric. This article has presented a list of dyeing machines for fiber and yarn dyeing.

2.3 types of dyeing machines used in textile industry:

There are different types of dyeing machine used in textile wet processing which are listed according to textile materials:

1. Fiber dyeing machine,
2. Yarn dyeing machine,
3. Fabric dyeing machine

2.4 Different types of dyeing machine:

All the fiber, yarn and fabric dyeing machines have listed in the following:

2.4.1 Fiber dyeing machine:

- Hussong loose cotton dyeing machine,
- Jagenbarg dyeing machine,
- Conical pan loose stock dyeing machine,
- Long close loose cotton dyeing machine,

- Dreze dyeing machine,
- Annual cage for loose stock dyeing machine,
- Simplex dyeing machine,
- Obermaier dyeing machine.

2.4.2 Yarn dyeing machine:

a. Hank form:

- Pulsatur hand dyeing machine,
- Hussong hank dyeing machine,
- Clauder Weldon hand dyeing machine,
- G.S.H hand dyeing machine.

b. Package form:

- Cheese dyeing machine,
- Cop dyeing machine,
- Warp dyeing machine.

Cheese dyeing machine:

- Franklin cheese dyeing machine,
- Obermaier cheese dyeing machine,
- Krantzgop cheese dyeing machine.

Cop dyeing machine:

- Long close cop dyeing machine,
- Mather and platt cop dyeing machine,
- Beaumont cop dyeing machine.

Warp dyeing machine:

- Ball warp dyeing machine,
- Zittau bean dyeing machine,
- Chain warp dyeing machine.

According to liquor movement:

- Liquor circulate but materials does not move i.e. all package dyeing machines,
- Materials move but liquor does not circulate i.e. jigger,
- Both materials and liquor circulate i.e. jet dyeing machines.

According to wet processing:

- Open dyeing process,
- Enclosed dyeing process.

According to dyeing materials:

- Hank dyeing machine,
- Loose stock form dyeing machine,
- Fabric form dyeing machine,
- Package form dyeing machine.

2.5 The dyeing process

Taking about 7-8 hours to be completed, dyeing process is divided into 3 parts;
Bleaching followed by 2 series of washing, dyeing followed by at least 3washings and the after-treatment. The number of washings certainly varies depending on shade of process and type of fabric. The bleaching profile of jersey cotton is given below.

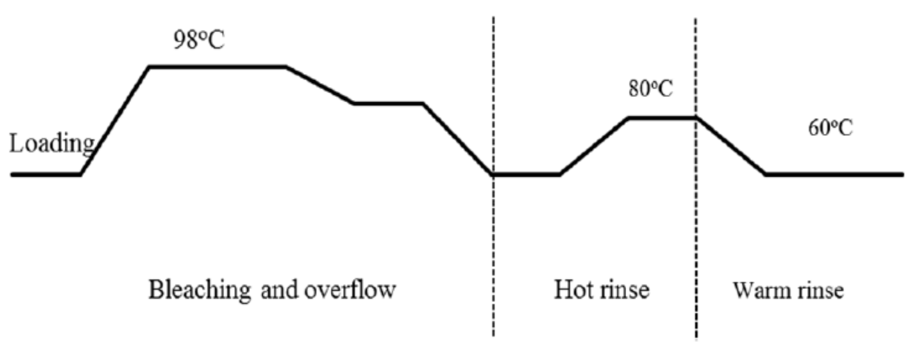

Fig-2.2 Bleaching profile diagram

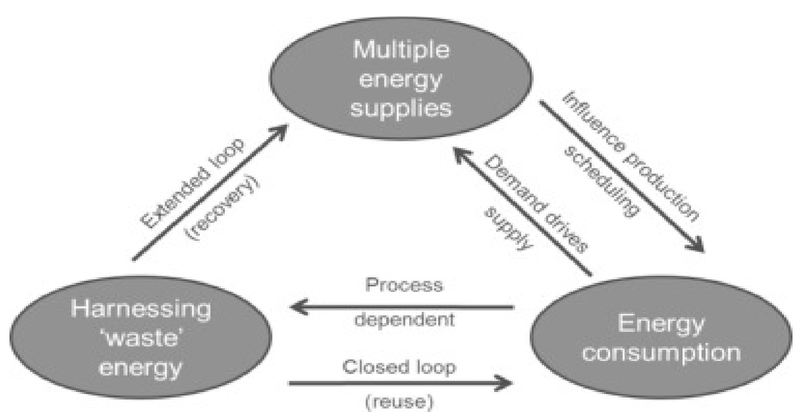

Fig-3 Life cycle of energy in an industrial facility

2.6 Textile Wet Processing Calculations:

Dyeing calculation is very important to dye the fabric perfectly. To calculate the different dyeing calculations, some important terms are frequently used in textile wet processing sector. Those terms have explained in this article.

Fig -2.4 dyeing machine

2.7 different terms used in wet processing calculation:

There are some important terms used in textile wet processing calculation, those are explained in the following:

2.7.1. Expression of mixtures:

There are a number of ways involved to calculate the weights and volume of textiles and chemicals. The major relations are given in the below:

a. Weight to weight (W/W):

This expression indicates that one unit of weight is related to the weight of another substance.

b. Weight to volume (W/V):

This expression indicates the weight units of one substance to the volume units of another material.

c. Volume to volume (V/V):

This expression relates the volume of one substance to the volume of another substance.

2.8.2. Molarity:

When one mole or gram molecular weight of solute is dissolved in one litre of solution is known one-molar (1M) solution.

For example,

1M HCl contains 36.5 gmHCl per liter,

0.1M HCl contains (36.5×1= 36.5) gmHCl per liter,

Again,

1M H2SO4 contains 98 gm H2SO4 per liter,

0.01M H2SO4 contains (98×0.01=0.98) gm H2SO4 per liter,

Again,

1M NaOH contains 40 gmNaOH per liter,

0.001M NaOH contains (40×0.001=0.04) gmNaOH per liter.

2.8.3 Normality:

When one gram equivalent weight of solute is dissolved in one liter of solution is known as one-normal (1N) solution. It is calculated from the molecular weight divided by the hydrogen equivalent (maximum valence of ion) of substance.

You can follow the below examples-

1N HCl contains 36.5 gmHCl per liter,

1N H2SO4 contains 98 gm H2SO4 per liter,

1N NaOH contains 40 gmNaOH per liter,

Now,

0.1N HCl contains (36.5×1= 36.5) gmHCl per liter,

0.01N H2SO4 contains (98×0.01=0.98) gm H2SO4 per liter, 0.001N NaOH contains (40×0.001=0.04) gmNaOH per liter.

2.8.4 Specific gravity:

The ratio of the weight of a define volume (density) of a substance to the weight of an equal volume (density) of some reference substance is known as relative density or specific gravity.

For liquids or solids, it is the ratio of the density (usually at 20°C) of water (maximum density) measured at 4°C. Since the weight 1cc water at 4C is 1gm the specific gravity of water is taken 1 at 4°C.

In general sense, specific gravity indicates the weight of 1ml of substance.

For example, specific gravity of sulfuric acid 1.84 means that 1ml of this sulfuric acid is 1.84gm.

2.8.5 Determination of specific gravity:

In textile wet processing industry, specific gravity plays an important role to maintain process parameter. Usually an instrument named hydrometer is used to determine the specific gravity of solution. But it can also be calculated by using the below formula.

Specific gravity (SG),

= (Weight of liquid/ volume of the liquid)

Specific gravity can easily determine by putting the weight value in grams in the formula.

2.8.6 pH of liquid:

In practice, pH of any liquid can be measured directly by using a pH meter. But is big question, what does the pH mean? What is the meaning of pH-5 and pH-10?

ActuallypH is the relative amount of hydrogen ion in a solution. It is defined as; pH is the negative logarithm of hydrogen ion in a solution. It measures the molls of hydrogen ion per liter of solution.

It should be noted here that,

pH value in the range of (0-3) indicates strongly acidic,

pH value in the range of (4-6) indicates weakly acidic,

pH value in (7) indicates neutral position,

pH value in the range of (8-10) indicates weakly alkaline,

pH value in the range of (11-14) indicates strongly alkaline.

2.8.7 Use of percentage:

In textile dyeing industry, “percentage” is used to express moisture regain, pick-up dye and other chemicals during treatment of textiles. In ordinary sense, “percentage” means parts per hundred. These parts must be in the same units i.e. grams per hundred grams, mili-liters per hundred mili-liters, kg per hundred kg etc.

“Percentage” can be expressed as the below formula:

$$\frac{\text{Unit of final substance}}{\text{Unit of original substance}} \times 100 = \text{\% final substance based on original weight}$$

2.8.8 Parts per total amount:

This expression is specially used in textile printing recipe calculation. It indicates “how many parts are in the total number of parts?” It can also be expressed by “parts per hundred parts of total”. The relation is in the below:

2.9 Industrial waste management: waste stream statistics

2.9.1 Waste Stream Composition: (While the u.s. produces around 236 million tons of municipal solid waste every year, the numbers for industrial waste are far less clear. some estimates go as high as 7.6 billion tons of industrial waste produced every year.

- Some big cities have to ship their municipal and industrial waste, paying other states to take it in for them. New York city, for example, spends around $1 million a day on long-haul trash.

- Currently, the u.s. recycles about 30% of its waste stream, even though the epa estimates that up to 75% of our waste stream is recyclable. over 60% of the average landfill is composed of paper, metals, glass, plastics, and food waste.
- About one-third of an average dump is made up of packaging material.
- only 1% of all plastic products in the united states are recycled every year, as are only 1% of all aluminum products.
- Paper and cardboard make up the majority of industrial waste products. this means that the average company can make a big impact simply by establishing a paper and cardboard recycling program.
- Americans throw away 25 million plastic bottles per hour.
- out of every $10 spent buying things; $1 (10%) goes for packaging that is thrown away. packaging represents about 65% of household trash.

Chapter 3

Methodology

3.1 Working Process:

- A Substantial energy of steam used in dyeing machine for processing & more than 25% exhaust steam are not uses in dying process. This exhaust steam used as a source of power generation.
- This exhaust steam used a specific pressure to turn the turbine.
- This specific pressure controlled by pressure gauge and excessive pressure release by using a pressure relief valve (PRV).
- By using controlled pressure turn the turbine and turbine turn the dynamo.

The dynamo rotates and generates the desired output.

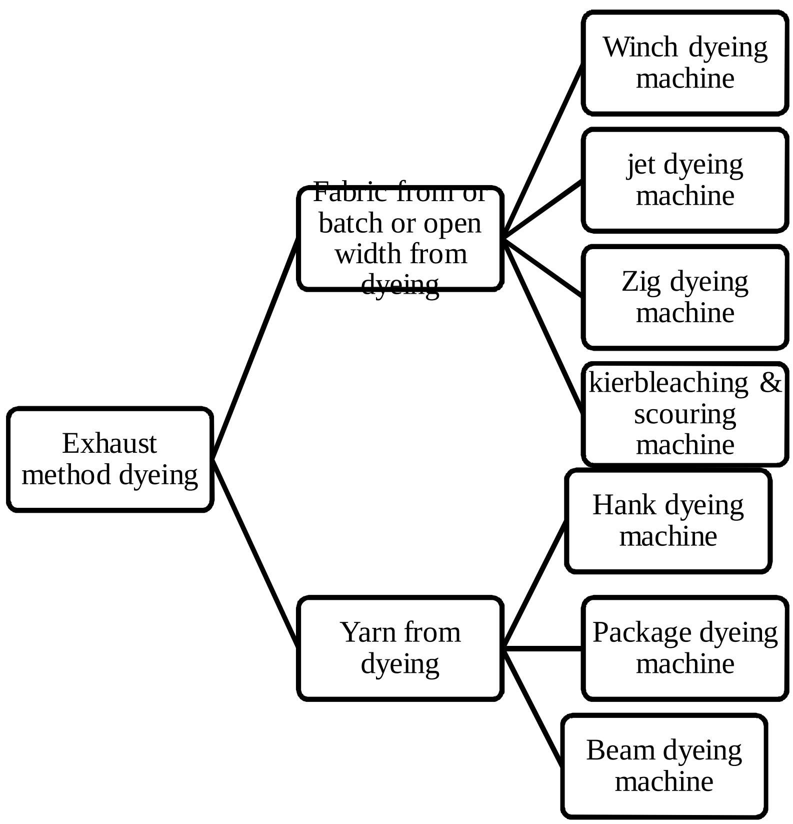

Fig 3.1: Working process of dyeing machine

3.2 Block Diagram:

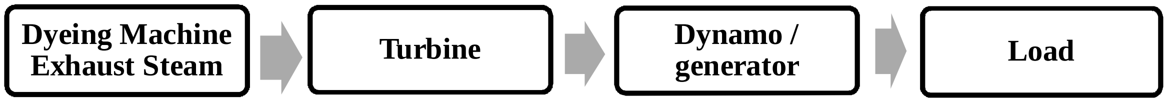

Fig 3.2: Block diagram of industrial power generation by using dyeing machine exhaust steam

As from the working procedure we learnt that the power generation using dyeing machine exhaust follows certain steps of order. The block diagram of power generation using dyeing machine exhaust steam is given below:

Dyeine Machine exhaust steam reheated by heat pump and generated steam to turn the turbine . turbine turn the dynamo and dynamo convert mechanical energy to electric energy

3.3 Components required

The components required for the construction of the project is shown below in tabular format

Table-3.1 Required materials & description (mechanical)

SL No	Items	Size	Unit
1	Pressure vessel	Dia 5”x Height 14”	Pcs
2	MSBar for stand	Height 9”	Pcs
3	Ball valve S.S	Dia ½”	Pcs
4	Pressure Gauge	(0 – 2 bar)	Pcs
5	Safety valve	Dia ½”	Pcs
6	Dynamo	6 volt	Pcs
7	Bulb	4 volt	Pcs
8	Galvanized pipe	Dia ½”	Rft
9	Galvanized elbow	Dia ½”	Pcs

3.4 Exhaust method: The traditional image of dyeing is that of vessels containing large volumes of dye**.** Solution into which textile goods are placed and dyed through the application of heat and various chemicals. The modern embodiment of these' long liquor' processes is what we refer to here as exhaust dyeing, the 'exhaustion' being the depletion of dye from the dye bath due to its absorption by the textile. Typical, but not mandatory, aspects of modern exhaust dyeing equipment are

- Pumped circulation of the dye liquor
- A sealed system which can be pressurized
- Microprocessor control of heating and flow.

In exhaust dyeing, all the material contacts all the dye liquor and the fibers absorb the dyes. The dye concentration in the bath therefore gradually decreases. The degree of dye bath exhaustion as a function of time describes the rate and extent of the dyeing process. The exhust method of dyeing are work on four steps. Which are as follows:

- Dissolving Dispersion
- Absorption
- Diffusion
- Migration

The process are described below:

i) Dissolving & Dispersion

Disperse dyes are nonionic dyes. So, they are free from ionizing group.They are ready made dyes and are insoluble in water or have very low water solubility.They are organic coloring substances which are suitable for dyeing hydrophobic fibers.Disperse dyes are used for dyeing man-made cellulose ester and synthetic fibers specially acetate and polyester fibers and sometimes nylon and acrylic fibers.Carrier or dispersing agents are required for dyeing with disperse dyes.Disperse dyes have fair to good light fastness with rating about 4-5.

ii)Absorption

The process of attachment of the dye molecule to the fiber is one of absorption: that is the dye molecules concentrate on the fiber surface. There are four kinds of forces by which dye molecules are bound to the fiber:1) Ionic forces 2) Hydrogen bonding 3) Vander Wals' forces and 4) Covalent chemical linkages

iii) Diffusion

The adsorption of five acid dyes onto chatoyant was studied. The equilibrium capacities based on the Langmuir analysis were 1.54, 2.66, 1.11, 1.25 and 1.03 mmol/g chitosan for

Orange 10 (AO10), Acid Orange 12 (AO12), Acid Red 18 (AR18), Acid Red 73 (AR73) and Acid Green 25 (AG25) respectively. The batch adsorption rate for the five systems based on an intraparticle diffusion rate parameter derived from the plots of dye adsorbed versus the square root of time indicated that the adsorption mechanism was predominantly intraparticle diffusion but there was also a dependence on pore size as the dye diffuses through macropore, mesopore and micropore respectively.

iv) Migration

The invention relates to a process for the end-to-end dyeing of cellulosic fibres or cellulosic fibre blends with direct dyes by the pad dyeing process, which comprises padding said fibre materials with an aqueous liquor containing one or more deionized dyes and a migration inhibitor, then expressing the padded goods and subsequently fixing the dye thereon.

The process of the invention is suitable for dyeing textile cellulosic fibres or cellulosic fibre blends end-to-end in shades of good allround fastness properties.

v) Process of Deception

Table 2: process f dyeing cycle

Process Description	Un-Insulated Machine	Heat Shield High Heat Insulated	Machine Energy Saving
Heat water form 40 to 135	1976	1765	10.75%
Process at 135	970	345	64.4%
Cool and Drain			
Process at 80	565	100	82.3%
Cool and Drain	1379	369	74.0%
Total for process	4890	2569	47.5%

Table -3: waste heat recovery of dyeing

Saving from heat recovery –Jet dyeing Machine			
Item	Unit	Value	
		As Is	To be
No of Jet Dyeing Machine	Nos	3	3
Steam consumption/Hr	Kg/Hr	150	150
Flash steam recovery potter	Kcals/Hr		28800
Savings in fuel	MT/Yr		29.5
Savings n energy cost	Rs /Yer		354000
Investment	Rs		200000
Simple payback period	Yer		0.6

3.4 Bourdon Tube Pressure Gauge:

Bourdon tube pressure gauges are extensively used for local indication. This type of pressure gages were first developed by E. Bourdon in 1849. Bourdon tube pressure gauges can be used to measure over a wide range of pressure: form vacuum to pressure as high as few thousand psi. It is basically consisted of a C-shaped hollow tube, whose one end is fixed and connected to the pressure tapping, the other end free, as shown in fig. The cross section of the tube is elliptical.

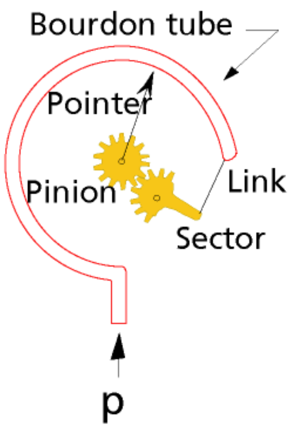

Fig 3.3: Pressure Gauge

When pressure is applied, the elliptical tube (Bourdon tube) tries to acquire a circular cross section; as a result, stress is developed and the tube tries to straighten up. Thus the free end of the tube moves up, depending on magnitude of pressure. A deflecting and indicating mechanism is attached to the free end that rotates the pointer and indicates the Pressure reading. The materials used are commonly Phosphor Bronze, Brass and Beryllium Copper. For a 2″ overall diameter of the C-tube the useful travel of the free end is approximately 1/8″ . Though the C-type tubes are most common, other shapes of tubes, such as helical, twisted or spiral tubes are also in use.

3.12 Applicable Code & Standard

- ASME (American Society of Mechanical Engineers) Boiler & Pressure Vessel Code, Section I
- ASME (American Society of Mechanical Engineers) Boiler & Pressure Vessel Code, Section VIII, Division II
- API (American Petroleum Institute) Recommended Practice 520 and API Standard 526, API Standard 2000 (low pressure - Storage tank

Chapter 4

Result and Discussion

4.1 Calculation:- We using 2500 watt heater and 12 volt transformer and get 12 volt of output and pressure 300 watt

Vin= 220 volt

Iout=25 amp

Vout=12 volt

Heat, p=2500 Watt

p=VI

Iin=2500/220=11.36Amp

Pout=25*12

300=Watt

Pin=2500Watt

Efficiency=Pout/Pin*100

=300/2500*100%

=12%

Finally we generated power by using dyeing marching exhaust steam. 2500watt heater use to heat pump to rise the temperature of low temperature waste heat & generated steam turn to turbine & the turbine turn the dynamo. The dynamo rotate & generated the output 6volt.

4.2 Applicability of our project:

1. Industrial building lighting system
2. Security system (emergency backup)
3. Industries light machineries
4. Light workshop
5. Industrial air conditioning system
6. Street lighting

4.3 Economic overview of our project:

A substantial amount of energy used by industry is wasted as heat in the form of exhaust gases, air streams, and liquids leaving industrial facilities. ... An increased use of waste-heat recovery technologies by industry would also serve to mitigate greenhouse gas (GHG) emissions.

4.4 Economics of waste-heat recovery:

The economic potential of waste-heat recovery systems depends on the capital recovery, which, in turn, depends on the annual fuel savings. Fuel savings can be difficult to predict because they depend on the time distribution of waste-heat and heat-load availability. Additionally, the rate of capital recovery of heat-recovery equipment differs substantially from production-related equipment as it is typically fixed by utility rates and current market values of fuels and cannot be as easily adjusted by manipulating product selling prices. The most appropriate type of heat-recovery equipment is determined based on technical feasibility, annual cost savings, and capital cost. It can be dangerous to only use the simple payback period. For example, industrial heat pump applications typically have longer simple payback periods (two to five years) than heat exchanger options although they usually provide better long-term solutions (DOE 2003b). Instead, proper discounted cash flow analysis should be used for accurate comparison of alternatives.

4.5 Advancements in heat recovery technology and applications:

1. A substantial amount of energy used by industry is exhaust streams. An increased use of waste-heat recovery technologies.

2. An added benefit of exhaust steam recovery is the reduction in GHG emissions.

3.There is no extra fuel need to turn the turbine.

4. No fuel burn means no environmental impact.

4.6 Disadvantage:

1.Only a little amount of power can generated.

2. When dyeing machine run steam can get that time.

3. Generating power is not stable depend upon steam.

4. If need to storage power need a big storage battery

5. For storage steam need a pressure vessel.

Chapter 5

Conclusion and Future Recommendation

5.1 Conclusion:

Bangladesh is a poor and densely populated small country. It is very important for the development of Bangladesh to supply electricity for the people at reduced cost. Also , the demand of electricity is now increasing rapidly. Industries facilities offer great opportunities for waste-heat recovery. Medium-to-high temperature exhaust gases from fossil-fuel-fired furnaces, boilers, and other process heating equipment typically account for the greatest opportunities for passive waste-heat recovery in industry. Utilize pinch analysis, if applicable; consider new technology options. Identify and implement cost-effective projects that minimize energy intensity.

5.2 Future Recommendation

Bangladesh is one of the most populated countries. The garment sector is one of the major sources of income in our country. The dyeing department is one of the major part of textile factories. We expect that in the near future, every textile factory will use their unused steam to production electricity to meet at least of their own factory needs. It will help our country overcome the power shortage and try to build a more developed country.

References

[1] CR Rhyner, LJ Schwartz, RB Wenger,Waste Management and resource recovery, MG Kohrell,2017

[2] Guide to energy management, BL Capehart, WC Turner, WJ Kennedy-2006

[3] Waste biomass-to-energy supply chain management: a critical syntheses, E Lakovou, A Karagiannidis,D Vlachos, A Toka... Waste management, 2010-Elsevier

[4] Direction of system planning program accounts and O & M compiled and published by the director of Public Relation, BPDB, 2017.

[5] Wikipedia

[6] Some Articles

[7] North-west power generation company

[8] Ashuganj power ltd

[9] Bangladesh Power Development Board