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LOW COST SLAUGHTERHOUSE WASTE TREATMENT

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Abstract: Indeed, given high strength of slaughterhouse effluent characteristics, it necessitates thorough treatment safe disposal and discharge into the environment. In my research, a combination of sedimentation, filtration, and coagulation methods was employed for effluent removal, and the results have demonstrated their effectiveness. These methods have proven to be very efficient in removing impurities and improving the quality of the effluent. This highlights the importance of employing a comprehensive and integrated approach to treat slaughterhouse wastewater, ensuring that it meets regulatory standards and minimizes its environmental impact.
When SWW is introduced into the sewage system, it increases the load on both the sewage network and sewage treatment plants (STP). Consequently, onsite treatment with integrated process emerges as optimal approach slaughterhouse effluent treat and disinfect, ensuring their safe discharge into receiving waters. This approach helps alleviate the burden on municipal sewage systems and STPs. To find a low cost effective method for reducing parameters of slaughterhouse waste treatment. The treatment processes follow to each slaughterhouse wastewater for environment.

Key words: Treatment, slow sand filter, wastewater, sedimentation.

I. Introduction:

The management of slaughterhouses often receives lower priority, especially when limited resources are available, leading to the absence of standardized practices. As a result, meat produced in these slaughterhouses, intended for the possible that the domestic retail market won't be identified as coming from the organized sector.
Historically, schemes formulate by both state and Central governments successful in humanizing basic infrastructure in slaughterhouses, including buildings, lighting, water supply, and drainage arrangements [24]. Small and medium-sized traders bring their own animals for slaughter under the current method, and they then collect the meat and the byproducts themselves. In current slaughterhouses, becomes challenging to access to by-product, potentially involves longer distances for transportation, may entail higher slaughtering fees, and may not provide control over specific methods of slaughter like Halal and Jatka, which are important considerations for local meat distributers. The numeral of animals bring by each distributor can vary significantly, making centralized slaughtering inconvenient for small traders.

Additionally, despite upgrades many slaughterhouses not old to their occupied or remain non-prepared. The Ministry of Food has a program to assist large, contemporary slaughterhouses for the supply of meat to domestic and international markets [3]. Consequently, it is crucial to involve all stakeholders during the planning stage to address these concerns effectively and ensure the successful implementation of slaughterhouse improvement initiatives.

There are certain pollution issues associated with the ongoing push to enhance meat production in order to meet the ever-increasing protein needs of the global population [15]. The preparation of meat results in pollution since good manufacturing practices and good hygiene practices are not followed. Safety procedures are hardly ever taken into account when animals are transported to the slaughterhouse, when they are killed, and when the hides and flesh are dressed. The abundance of suspended solids and liquid waste, as well as the odor creation, are the main environmental issues connected to this abattoir effluent [20]. Because blood, fat, dung, urine, and meat tissues are lost to the wastewater streams during abattoir processing, it has been established that the effluent from slaughterhouses contaminates both surface and groundwater.

The domestic market in India is expanding along with the number of fast food restaurants. However, the meat industry continues to be one of the worst organized industries [11]. Even though meat consumption is rising, the quality issues have not yet received enough attention. The Food Safety and Standards Act of 2006 require all food products produced in the nation to adhere to the set standards. One thing that likely received little consideration in this manner is meat. Municipal slaughterhouses are governed by corporate or municipal authorities, and no effort has been made to elevate the production of meat to the status of a significant economic activity. Environmental issues, a lack of understanding, and insufficient private engagement are some of the obstacles to maintaining hygienic conditions [16].

The primary sources of SWW are the leftovers from production, cleaning of the facilities, and the excrement, urine, blood, lint, fat, corpses, and non-digested food in the intestines of the killed animals [27]. Depend on the industrial process and water requirement the SWW composition changes. However, they typically have high concentrations of nutrients and organics, which are typically assessed as total organic carbon (TOC), total suspended solids (TSS), total nitrogen (TN), and phosphorus (TP) [23]. Due to their complex composition of fats, proteins, and fibers, as well as the presence of organics, nutrients, pathogenic and non-pathogenic microorganisms, detergents and disinfectants used for cleaning activities, and pharmaceuticals for veterinary purposes, slaughterhouse effluents are regarded as harmful on a global scale. Consequently, the handling and disposal of treated waste into the river agriculture uses [26].

II. Methodology:

The process of collecting slaughterhouse wastewater samples was initiated, and this phase involved adhering to a well-defined sampling protocol. Before embarking on the sampling program, certain essential elements needed to be specified:

Sampling Plan: A comprehensive plan outlining the objectives, locations, frequency, and methodology of sampling should be developed. That plan provides a structured advance to collecting delegate samples.

Labeling Sample: Appropriate labeling of every sample is crucial for precise identification and track. Information should include about labeling such as the location, time, date, and any unique identifiers.

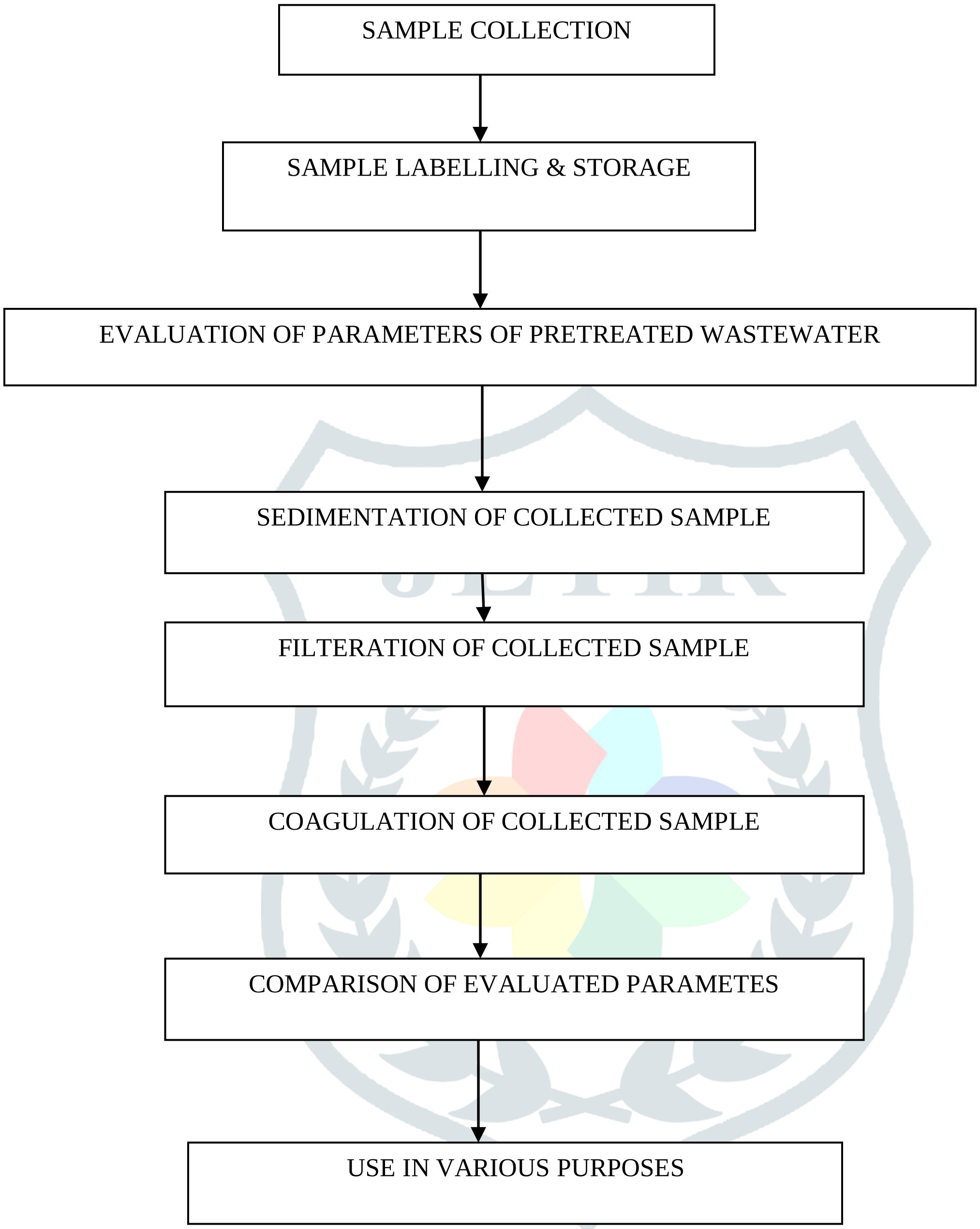
Sample Storage: To maintain the integrity of the collected samples, guidelines for proper storage conditions, including temperature and protection from contamination, should be established.

Sample Constituents: Clearly define the specific constituents or parameters of interest that will be analyzed in the collected samples. In this case, parameter such as Total Suspended Solids (TSS), Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), and pH were among parameters of interest.

The samples were collected from Billauchpura Lucknow Slaughterhouse, where lots of slaughterhouse collective production of meat, and were placed in sealed plastic containers. These samples were then subjected to analysis within 24 hours of collection, focusing on physical-chemical parameters like BOD, COD, TSS, and pH. The project aimed to evaluate various parameters of the collected wastewater after applying the proposed treatment method.

A well-defined and systematic sampling process is critical for obtaining reliable data and ensuring the success of the wastewater treatment project.

Flow Chart of Methodology



III. Result And Discussion:

The information provided indicates the effectiveness of various treatment processes on the concentration of COD (Chemical Oxygen Demand), TSS (Total Suspended Solids) and BOD (Biochemical Oxygen Demand), in the wastewater. Here's a summary of the findings:
Sedimentation Process:
BOD concentration was reduced by approximately 20%.
COD concentration was reduced by approximately 23%.
TSS concentration was reduced significantly by approximately 57%.
Coagulation Process (Using PaCl at 100 mg/L):
BOD concentration was reduced by approximately 67%.
COD concentration was reduced by approximately 71%.
TSS concentration was decreased also.
It's notable that the coagulation procedure, particularly when use PaCl at a amount of 100 mg/L, considerably improved the removals efficiencies of TSS, COD, and BOD.
Filtration Process:
BOD and COD concentration were decreased by approximately 38% and 37%, respectively, compare to the original levels before the sedimentation.
After the filtration process, BOD, COD, and TSS, concentrations were decreased by approximately 80%, 78%, and 90%, correspondingly.
These outcome propose that the arrangement of sedimentation, coagulation (with PaCl at 100 mg/L), and filtration process prove selected extremely effective in reducing the concentration of concentration during slaughterhouse wastewater. The investigational filter model played a considerable role in achieves improvement.
Overall, that examination demonstrates this treatment method is not only effective but also cost-well-organized for removing impurity from slaughterhouse wastewater. That contributes toward improving characteristic of slaughterhouse wastewater; manufacture it safer for discharge or further treatment.

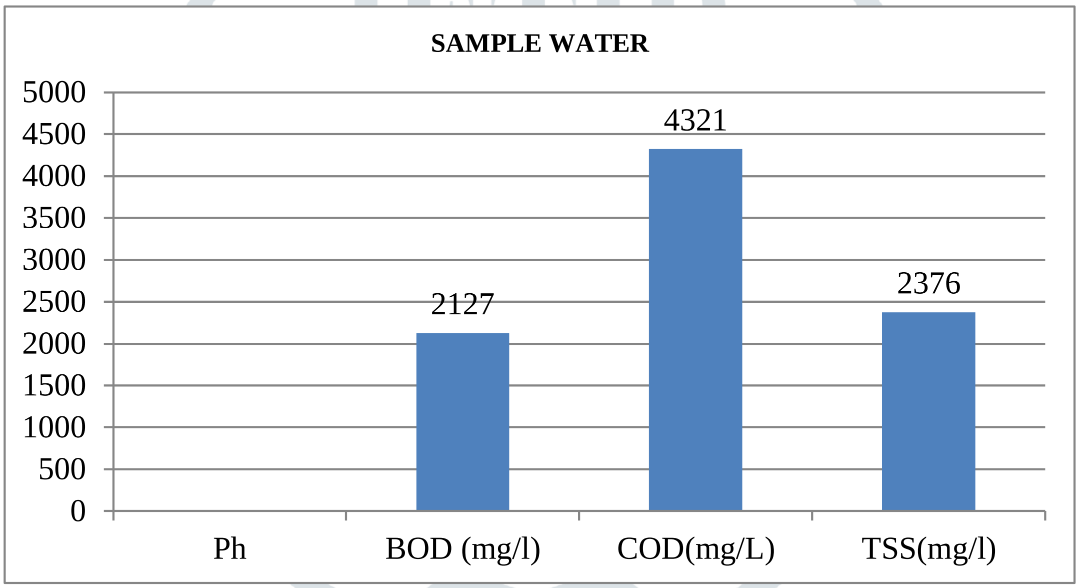
3.1. Parameters of Slaughterhouse Waste Water

The wastewater samples were collected and subjected to psychoanalysis to find out their physiochemical and organic characteristics. Various parameters were analyzed to assess the wastewater quality. The specific parameters that were measured include in table 1.

Table1: Slaughterhouse waste parameters.

S NO.	PARAMETERS	RANGE
1	COD(mg/L)	4321
2	BOD (mg/L)	2127
3	TSS(mg/L)	2376
4	Ph	7.2

FIGER 1: GRAPHICAL REPRESENTATION OF CHARACTERISTICS OF COLLECTED SLAUGHTERHOUSE WASTE WATER



3.2. Sedimentation

A physical water treatment method called sedimentation is utilized to let suspended materials in water fall to the bottom of the water body under the gravity of gravity. Here are some essentials of sedimentation:
Suspended Solids (SS): Suspended solids refer to the dry mass of solids retained by filters with a specific relative porosity to the water volume sample. This includes particle larger than 10 micrometers (10µm) in dimension.

Colloids: Colloids are particles with sizes ranging from 0.001 to 1 nanometers (nm), depending on the method used for measurement. These tiny particles have a lower chance of naturally settling because electrostatic forces balance gravity. In sedimentation, a particle will settle only if:

The upward water velocity in a vertical ascending flow is lower than the maximum sedimentation velocity. The ratio of the tank's length to its height is greater in a longitudinal flow than the ratio of the water velocity to the limit sedimentation velocity.

Here are four types of sedimentation processes:

Dilute Non-flocculent Free-settling: This involves the settling of suspended solids in a dilute solution without the formation of flocs (aggregates of particles).

Dilute, Flocculent: In this case, particles can flocculate (come together to form larger aggregates) since they settle.

Concentrated suspension Zone of Settling (Sludge Thickening): This process is used for concentrated suspensions where particles settle in distinct zones, allowing for mud thickening.

Concentrated Suspension Compression (Sludge Thickening): Here, concentrated suspensions are compressed to further thicken the sludge.

Sedimentation is a critical process in water treatment and wastewater treatment, as it helps remove solids from water, making it clearer and safer for various uses.

3.3. Laboratory analysis of sample after sedimentation

The parameters of slaughterhouse wastewater mentioned were likely tested to assess the impact of sedimentation on wastewater before and after sedimentation. Here's a summary of the results in table 2:

Table2: Parameters after sedimentation.

S NO.	PARAMETERS	BEFORE SEDIMENTATION	AFTER SEDIMENTATION
1	COD(mg/L)	4321	3328
2	pH	7.2	7.4
3	BOD(mg/L)	2127	1688
4	TSS(mg/L)	2376	1007

3.4. COAGULATION OF SLAUGTERHOUSE WASTE WATER

The chemical coagulation is unit procedure employed for the taking away of colloidal particles from water. This procedure involves several steps:

Chemical Addition: The process begins with the addition of chemicals, often in the form of slurries or dry powders, to the water. These chemicals are added to aid in the coagulation process.
Chemical Dispersion: The added chemicals, such as salts of trivalent metals like iron and aluminum, are quickly dispersed throughout the water solution. This dispersion helps initiate the coagulation process by creating conditions for particle aggregation.
Decantation or Settling: After the chemicals are introduced, the water is allowed to undergo a settling period..
Separation: Once the floc has grown and settled, the separation of solid particles and liquid phases takes place.
The chemicals typically added in chemical coagulation processes include:
Coagulant: This is usually a salt of trivalent metal, such seeing as aluminum or iron. These coagulants help destabilize and neutralize colloidal particles in the water.
Control Chemical: Often, a chemical is added to control the pH and alkalinity of the water. Lime is a commonly used control chemical for this purpose.

Coagulant Aid: Coagulant aids, such as activated silica or polyelectrolyte's, may be included to enhance the coagulation process, improve floc formation, and increase the efficiency of particle removal.
The types, point, amounts, and order, in the treatment procedure which these chemicals are added critical factors in the coagulation process. Chemical coagulation is used widely in wastewater and water treatment to remove impurities and clarify water for various applications.
Coagulation and flocculation experiments were conducted using PaCl (Polyaluminum Chloride) as a coagulant in the jar test to investigate its impact on the elimination efficiencies of BOD (Biochemical Oxygen Demand), TSS (Total Suspended Solids) and COD (Chemical Oxygen Demand), in slaughterhouse wastewater.

Various doses use of PaCl as a coagulant be tested, ranging from 100 to 0 mg/L, in order to determine the optimum dosage of PaCl for the removal of pollutants. The consequences showed that at lower doses of PaCl (25 mg/L), the elimination efficiencies for BOD, COD, and TSS reached a maximum of them 34%, 41%, and 58%, respectively.

As the dosage of the coagulant (PaCl) increased, efficiency of coagulation process to be also increased. The data exhibited a substantial improvement in performance as the PaCl dosage was raised, culminating in a significant enhancement in pollutant removal efficiency, particularly up to a dosage of 100 mg/L.

In summary, the study demonstrated that the make use of PaCl a coagulant in the treatment of slaughterhouse wastewater effectively increased the removal efficiencies of BOD, TSS, and COD, with the optimal results achieved at higher coagulant dosages.

3.5. Parameters of Slaughterhouse Wastewater after Coagulation

Following are the parameter record after apply 50gm/L and 100mg/L dosage of PaCl in laboratory of wastewater in table 3.

Table3: Parameters after coagulation.

S NO.	Parameters	50mg/L	100mg/L
1	COD(mg/L)	2133	1120
2	TSS(mg/L)	565	289
3	BOD (mg/L)	1118	709
4	pH	7.3	7.4

3.6. Filtration

Filtration is a process that involves various mechanical, physical, or biological techniques to separate solid particles from fluids, which can be either liquids or gases. During filtration, a medium is introduced through which only the fluid can pass. The portion of the fluid that successfully passes through the filtration medium is referred to as the filtrate.
In physical filtration, oversize solid particles present in the fluid are retained by the filtration medium, while the fluid can pass through. In biological filtration, particulate matter is trapped and can be ingested or metabolized by microorganisms present in the filtration system, while the final product is purified.
Filtration processes occur both naturally in various environments and in engineered systems. Filtration plays a crucial role in various applications, from ensuring clean water for consumption to separating particles in industrial processes. It is a versatile and widely used method for separating solids from fluids.
Here the filters Type:
Slow Sand Filter
Rapid Sand Filter
Roughing Filter
Slow Sand Filter: General Design Criteria for Slow Sand Filters As Per IS 11401 (Part-2):1990
The information provided appears to describe the specifications of a filtration system or structure. Here is a breakdown of the given parameters:
Height: The height of the structure is 500 mm.
Width: The width of the structure is 250 mm.
Material 1: The material used for the structure is glass, and it has a thickness of 8 mm.
Fine Sand: A layer of fine sand with a particle size of 1.8 mm is present, and its depth is 60 mm.
Material 2: Another layer of material is described as "aggregates" with a particle size of 6.3 mm, and its depth is 60 mm.
Material 3: There is a third layer of material described as "aggregates" with a larger particle size of 16 mm, and its depth is 130 mm.

It seems like you have provided the specifications for a filtration or drainage system, but further context or details would be needed to fully understand its purpose and functionality.

General plan criteria used for slow sand filter as per IS 11401(PART-2)-1990, table 4.

Table4: Design criteria of slow sand filter.

S no.	Design criteria	Recommended value
1	Filtration Rate	0.1-0.2 m/h
2	Filter Bed Area	200 m3 per filter
3	Water Demand	40 lpcd
4	Design Period	15-30 years
5	Period of Operation	24 hr
6	height of under drain including gravel layer	0.3-0.5 m
7	Height of supernatant water	1 m
8	Depth of Filter Sand Initial Minimum Specification of Sand Effective Size Uniformity Coefficient	0.8-0.9 m 0.5-0.6 m 0.15-0.30 mm Max 5

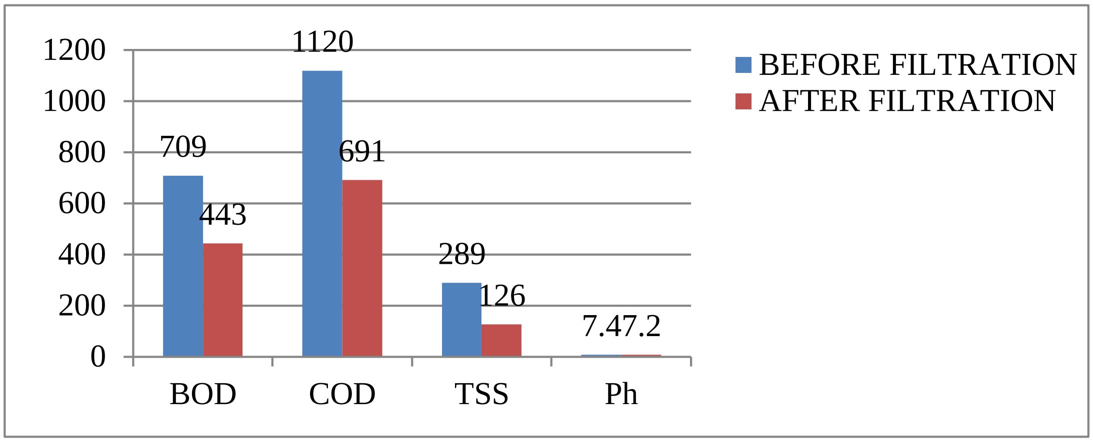
Psychoanalysis of Sample Carried Out In Laboratory after Filtration

It seems like to be evaluated in laboratory tests certain parameters after the filtration of collected wastewater samples. The parameters mentioned include in table 5.

Table5: Parameters after filtration unit.

S no.	PARAMETERS	BEFORE FILTRATION	AFTER FILTRATION
1	TSS(mg/L)	289	126
2	COD(mg/L)	1120	691
3	BOD (mg/L)	709	443
4	pH	7.4	7.2

Figure 2: Graph representation between before and after filtration



.Conclusion

These results suggest that the combination of sedimentation, coagulation (with PaCl at 100 mg/L), and filtration processes proved to exist highly effectual in tumbling the concentration of impurities in slaughterhouse wastewater. The experimental filter model played a significant role in achieving these improvements.

Overall, this investigation demonstrates that this treatment method is not only effective but also cost-efficient for removing impurities from slaughterhouse wastewater. It contributes to improving the quality of the wastewater, making it safer for discharge or further treatment.

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