RECOVERY OF DRIED YEAST SLUDGE FROM DISTILLERY SLOPS AS POTENTIAL RAW MATERIAL ADDITIVE FOR ANIMAL FEEDS AND SOLID FERTILIZER AS WASTE MINIMIZATION AND UTILIZATION AT

CENTRAL AZUCARERA DE TARLAC

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I. INTRODUCTION

Central Azucarera de Tarlac (CAT) is an integrated plant which comprised of the sugar mill, refinery, and distillery. The sugar mill has a capacity of 7,200 tonnes cane which started its operations in 1958 while the refinery produces 7,500 L-kg bags per day started its operations in 1965.

The C.A.T. distillery plant, which started operations in 1968, as Tarlac Distillery Corporation or TADISCO, presently has four (4) distilling columns with a combined output of 60,000-gage liters 190° proof rectified alcohol per day. By-products of the fermentation process are carbon dioxide, recovered in the Carbon Dioxide Recovery Plant at 30TPD and dried yeast, recovered in the Yeast Plant at 800KGPD. Both plants started operating in 1980.

The challenge constantly facing any plant is the generation of wastes having high organic loads and its treatment and to find application to by-products of the selected treatment processes involved. The focus of this paper is how the CAT Distillery plant recovers the slops wastes from fermentation and distillation in order to control harmful discharge to environment and also to recover the crude dried yeast for possible application and its comparison to other wastes generated by the plant.

II. RELATED WORKS

Production of bio-ethanol alone registered a total of 455.5 million liters rated capacity for 2018-2019 from 14 SRA-Registered Bioethanol Producers alone. This can be translated into equivalent spent wash pollutant produced ranging from 12 to 15 times the product alcohol volume or more.

Parameter	**Range**
pH	3.6-4.8
Total Suspended Solids	4,000-5,000
B.O.D.	40,000-50,000
C.O.D.	60,000-95,000

Table 1. Characteristics of CAT Distillery Spent Wash

This spent wash contains dissolved impurities, nutrients added in the fermentation wort, by-products of fermentation process as well as suspended impurities, pigments and contains high organic load resulting to extremely high BOD and COD values. This poses a tremendous polluting potential if not managed accordingly.

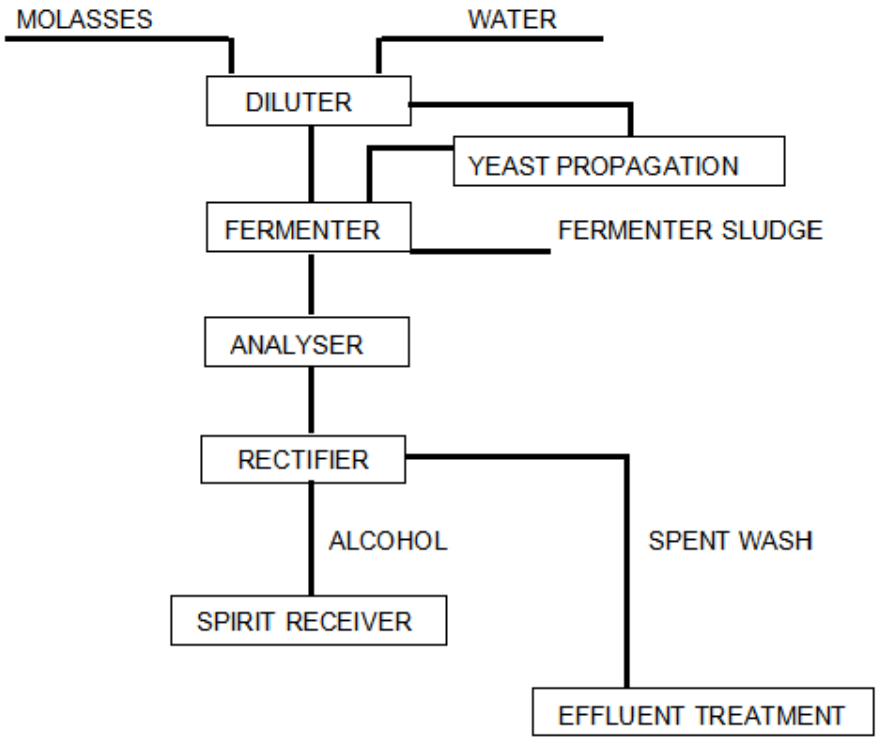

Figure 1. Typical Distillery Process Flow Diagram

The present alternative treatments and application for spent wash treatment were as follows:

A. Anaerobic Digestion with Biogas Generation

The high organic load of spent wash makes it a suitable feed for anaerobic biomethanation process where production of biogas for supplemental energy supply of the plant can be generated. This is easy to operate but with high investment cost.

B. Concentration to Incineration with Potash Recovery

Spent wash was first neutralized with lime and filtered and fired to evaporators and concentrated to about 60% solids then burnt in an incinerator and converted into ash. The resulting ash is a about 37% potash or potassium oxide which is further leached with water and neutralized with sulphuric acid and crystallized to form mixed potassium salts which can be used as fertilizer. This is preferable if the area availability is limited.

C. Anaerobic/Aerobic Composting with Press Mud from Sugar Mill

Press mud from sugar mill is used by mixing with distillery effluent to produced organic compost. This process can achieve zero effluent released to environment if quantities of fresh mud and and distillery effluent are evenly formulated.

D. Distillery Wastewater Utilization through Fertigation

This is practised usually after harvesting of fields as conditioning due to naturally occurring organic matter and available nutrients in the spent yeast culture which improves the characteristics and physical structure of the soil. This treatment disposal is getting attractive nowadays due to the conservation of ever depleting water resources and proper disposal of effluents.

E. Coagulation/Electro-Coagulation of Spent Wash

Emerging technology that uses coagulators to substantially reduced COD loading from spent wash with considerable color removal efficiency which can reduce negative effect of effluent on stream discharge which can cause eutrophication.

III. SYSTEM MODEL: CAT Recovery of Crude Dried Yeast / DYS Recovery Process

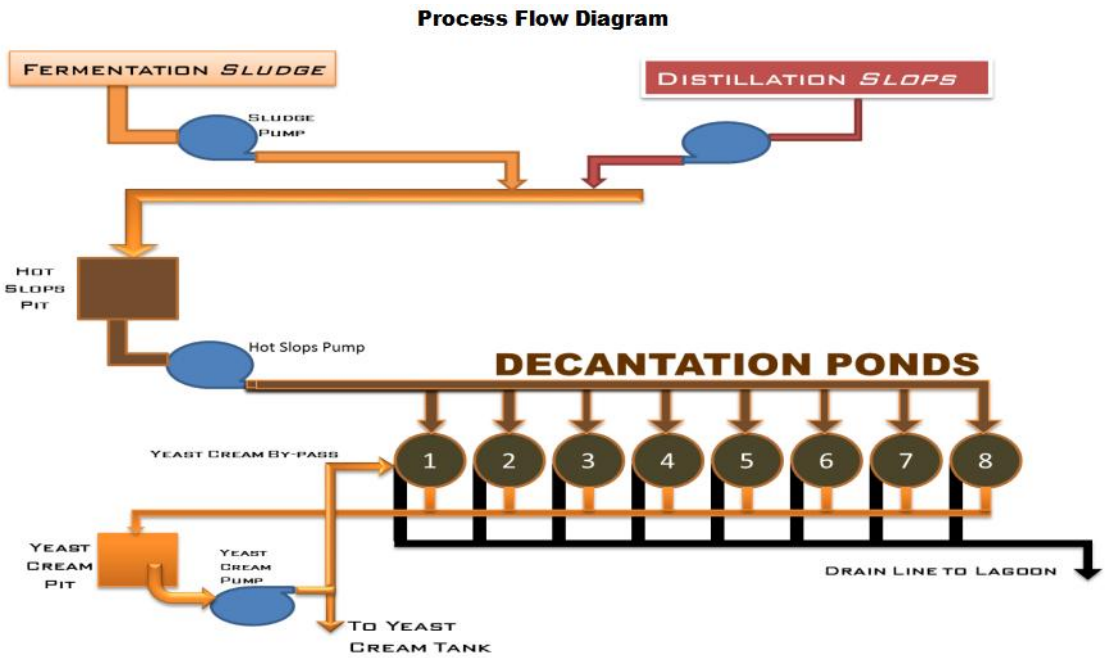

Figure 2. CAT Yeast Cream Sedimentation Process Flow Diagram

Figure 2 shows the collection process flow diagram of how the yeast cream as raw material is harvested, the spent wash is the combination of fermentation sludge and distillation slops pumped into 8 units of decantation ponds one by one until the settling parameter of 18 deg Brix is reached having the desired viscosity.

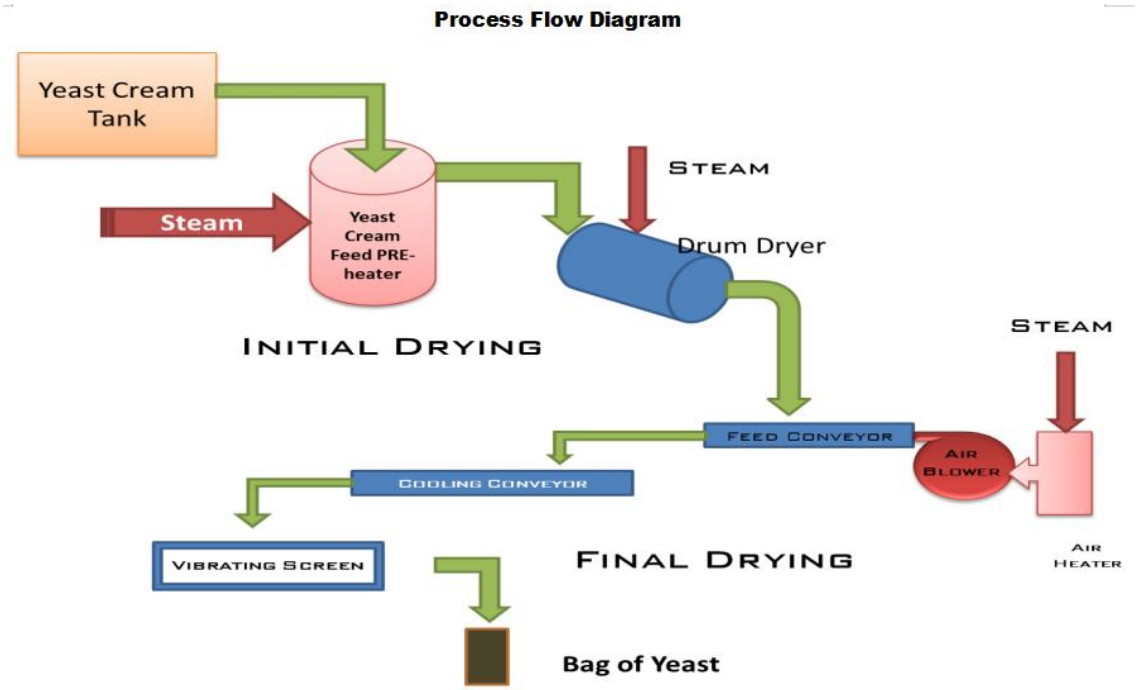

Figure 3. Yeast Plant Process Flow Diagram

Figure 3 shows the Yeast Plant Process Flow diagram with the use of live steam, the harvested yeast cream was pre-heated first in a mounted tank and allowed to flow by gravity into a steam heated drum dryer picking up yeast cream on one side rotating at 3-5 rpm and scraping the partially dried yeast cream on the other side with screw conveyor for its transport. It is then dropped into a feed conveyor fired with hot air from a steam fired heater and set to recirculate at the cycle for ample drying. It then goes into the cooling conveyor then screened for particle size consistency and bagged at 45kg each.

IV. METHOD

Samples of different waste streams were collected inside the plant and were analyzed for NPK parameters, %OC (Organic Carbon), pH and moisture and compared for possible applications.

V. RESULTS

Samples	%moisture	pH	%OC	N (ppm)	P (ppm)	K (ppm)
Mill Ash	**51.7**	**9.48**	**1.04**	**N/A**	**1,174**	**4,385**
Dried Yeast Sludge	**10.4**	**4.17**	**37.50**	**49,600**	**3,448**	**21,316**
Decanted Slops	**-**	**4.51**	**2.08**	**1,400**	**86**	**3,803**
Mud Press	**74.4**	**4.37**	**8.36**	**3,500**	**3,386**	**639**

The above results showed that dried yeast sludge registered the highest in all parameters tested except the %moisture and pH of which it is the lowest in value.

VI. POSSIBLE APPLICATIONS

A. As Solid Fertilizer

Of all the waste stream produced in the plant, DYS has been tested to have the highest results in terms of ppm of all the primary nutrients essential for healthy plant growth. The CAT agronomist is yet to finalize the formulation of a fertilizer mix using DYS and other CAT waste by-products and initial results are promising. This can be introduced to local farmers and encouraged for its use over synthetic fertilizers to save cost.

B. As Animal Feed Supplement

CAT DYS has been analyzed to contain %crude protein at about 25%. Numerous studies have been documented of trials and inclusion of DYS in poultry diet. It has high nutritive value and has no toxic substance. A study by Rameshwari. K, Sudha & Karthikeyan, Subburamu concluded that 30% level of incorporation can be safely added on growing chicks with superior feed conversion ratio as opposed other percentages. It has been observed that poultry that consumed enhanced DYS feeds showed decreased abdominal fat and E. coli count due to mannan oligo-saccharides (MOS), yeast cell walls, helps in binding E. coli which can act as natural antibiotic that boosts correct digestion and immunity. This can lessen also the cost for synthetic antibiotic use.

VII. CONCLUSION

Overall, DYS has a great potential for further development into raw additive for plant and animal food supplement. This is a worthwhile pursuit since this can benefit not just the distiller, but the farmers and the environment as well.

Regarding the use of waste-derived products, a greater policy review and adjustment needs to be done to be able to fully realize its potential and further implications or effects, and all sectors - the academe, industry and the local government should be involved to make the practice of using waste-derived products into good use.

VIII. BIBLIOGRAPHY

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