C.O.D. REDUCTION OF ACID CONDENSATE

TWIN RIVERS PAPER COMPANY

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BACKGROUND

Twin Rivers Paper company (TRPC) is a pulp mill in Edmundston, N.B. which produces 700 tonnes of magnesium-based sulfite pulp daily. Due to the new Pulp and Paper Effluent Regulations (PPER) coming into effect in 2021, TRPC are required to reduce their current output of chemical oxygen demand (COD). The acid condensate stream from cooking liquor recovery currently contributes 20% of the COD output.

OBJECTIVE

The primary objective of the project is to reduce the COD loading sent to the on-site aerated stabilization basin (ASB) from the acid condensate stream by at least 80%. Additionally, achieving a source of revenue from the removal of marketable compounds, such as Acetic Acid and Furfural, within the stream to offset operating costs was considered a secondary objective.

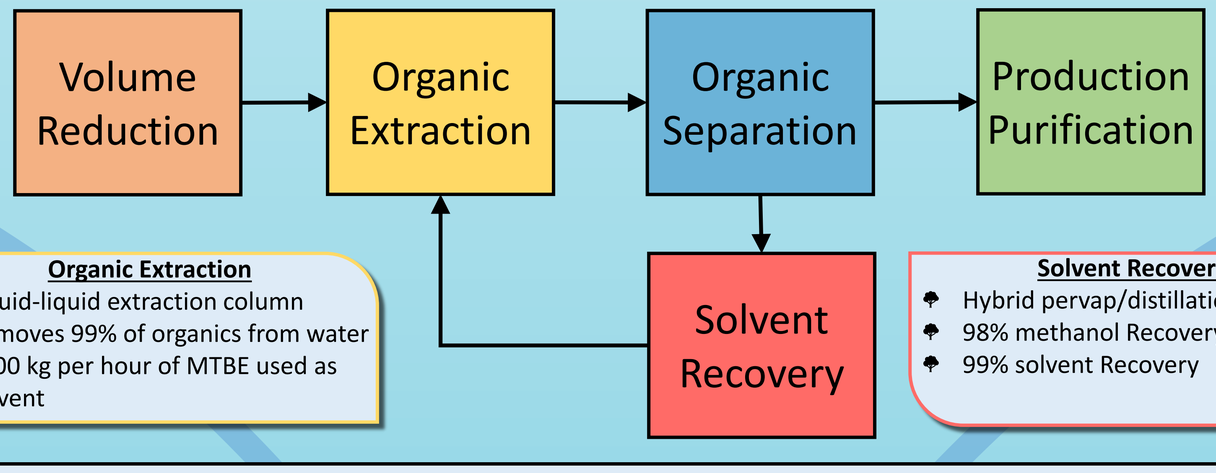
Reverse Osmosis: Reverse Osmosis was used to reduce the large amount of water in the acid condensate stream. The design requires two separate systems in series to achieve the desired concentration of the organics. A local mill in New Brunswick currently uses this technology for a similar application.

Liquid-Liquid Extraction: This technology has been used since 1983 in a pulp plant in Austria with a similar objective as the one of this project. The design calls for 20 stages and a column height and diameter of 2.5 and 1 meters respectively.

Volume Reduction
- Reverse Osmosis System
- 99% volume reduction achieved
- 90% of organics retained

Organic Separation
- Two distillation columns
- Separates solvent and organics
- Recovers acetic acid and furfural

Product Purification
- Series of small distillation columns
- Furfural product of 94% purity
- Glacial (99.4%) acetic acid purity



Organic Extraction
- Liquid-liquid extraction column
- Removes 99% of organics from water
- 5000 kg per hour of MTBE used as solvent

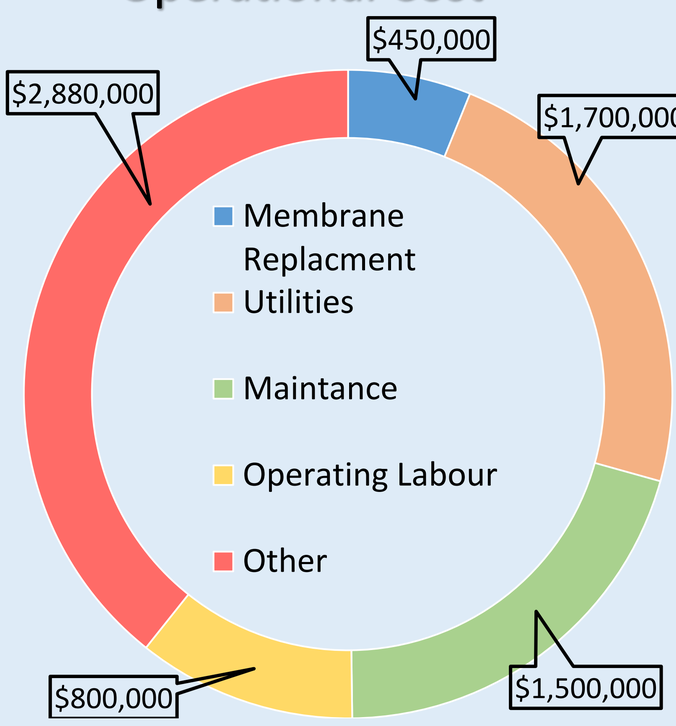
Solvent Recovery
- Hybrid pervap/distillation system
- 98% methanol Recovery
- 99% solvent Recovery

Pervaporation: Pervaporation (Pervap) is widely used for the separation of organics and has been used industrially to separate MTBE and methanol. The permeate evaporates as it crosses the membrane due to the low vacuum pressure that is created by a condenser.

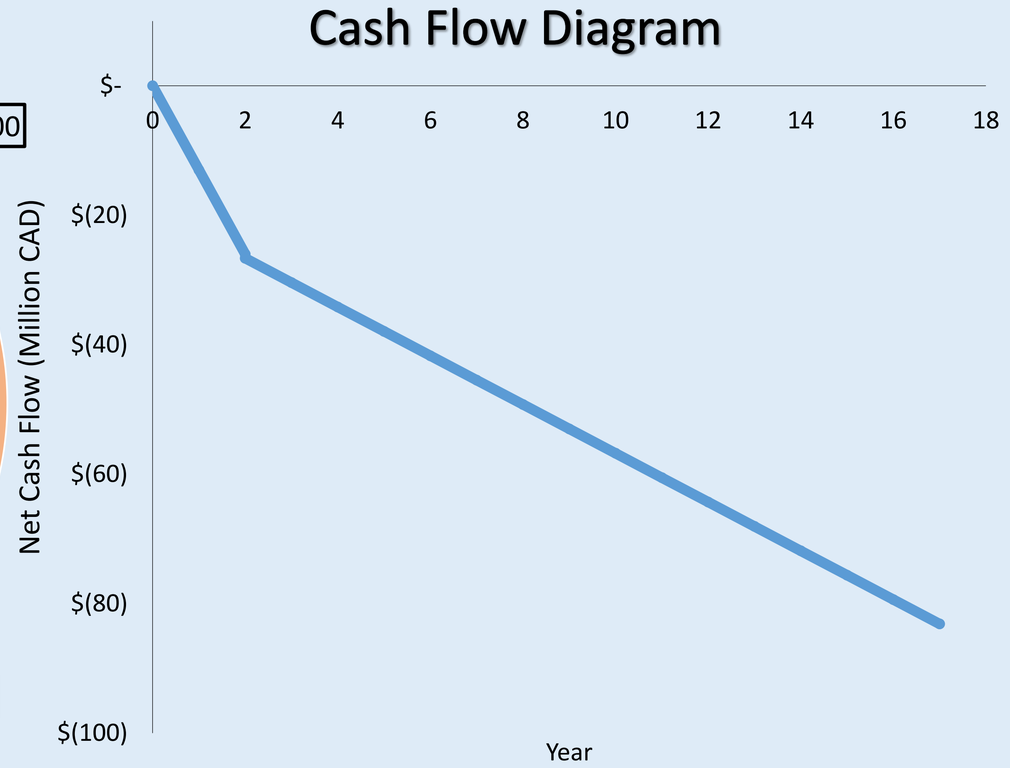
Distillation: This technology is widely used in industry for various separations based on boiling point differences. The distillation towers in the process are all relatively small with the largest being approximately 10 meters tall with 18 trays. In this project distillation was applied for the purification of acetic acid, furfural, and methanol.

ECONOMICS

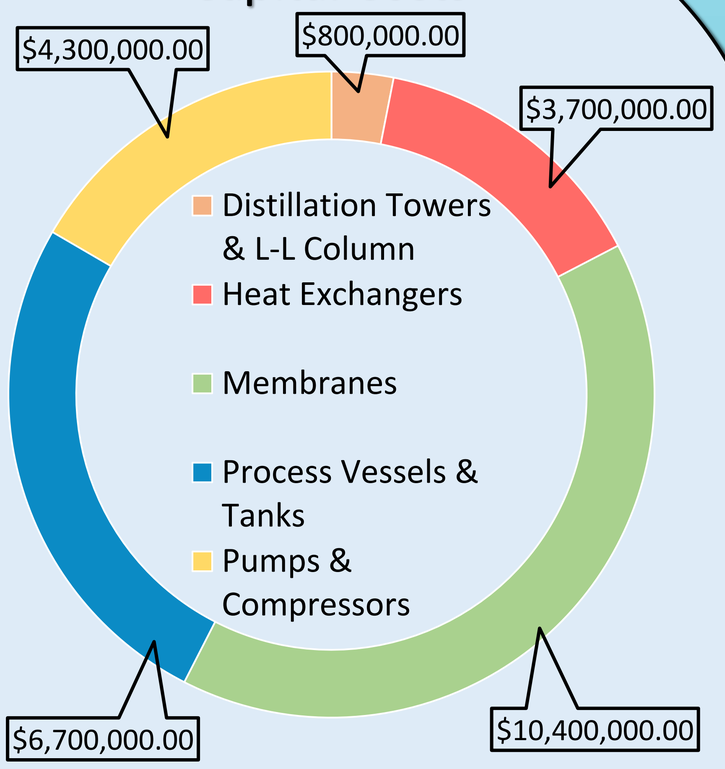
Operational Cost



Cash Flow Diagram



Capital Costs



Operating Cost: $7.3 million annually

Product Revenue: $1.0 million annually

Savings: $2.5 million

ROI -14%

Capital Cost: $26.7 million

CONCLUSIONS

The proposed process can reduce the COD by an estimated 86% and recover $1 m worth in products annually.

Despite a loss of approximately $4 million a year, the project may be considered a new cost of business and will aid the mill in meeting the 2021 PPER which ensures the mill can still operate well into the future.

Due to how dilute the acid condensate is, a volume reduction operation would be necessary regardless of the desired end use of the organics.

RECOMMENDATIONS

Anaerobic digestion is a typical technology used for COD reduction. Although this technology was not considered for this project its feasibility should be investigated.

A significant portion of the operating cost is attributed to the electrically heated reboilers. Increasing steam production for use instead of electricity could reduce the utility cost drastically.

Using additional reverse osmosis membranes in series would result in a concentrated organic stream that could be directly incinerated. This should be considered due to its use in local Kraft mills and would reduce the number of unit operations.

ACKNOWLEDGMENTS

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