

RECOVERY OF A SOLVENT FROM WASTEWATER

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SUMMARY

Permanently growing population, its continuously increasing energy demand requires the efficient usage of the funds and sources to assure sustainability; the most popular subject in today's world. As the result, energy and cost efficiency are the most important issues in the chemical industry, which works to improve the life standard of human being with advanced technologies.

The rising concern about the shortage of the material and energy sources leads to the importance of recovery which lowers the energy and money expenses with procuring re-usage of raw materials.

The main purpose of the project is to recover NMP and water from waste water and feeding these components back to the membrane production process. Also, removing the heavy ends (PVP and glycerine) as waste from the process is another aim of the project. The main outcome of the project is recovering pure NMP and water from waste water thinking of economic analysis and environmental effects to feed these components back to the membrane production process for re-use.

Existing membrane production process generates waste stream of 200m³/day based on 8000 operating hours per year significant quantities of waste water containing low concentrations of organic solvent N-methyl-pyrrolidone (NMP) at about %2 by weight which is 4000kg/day NMP, and traces of other organics such as polyvinylpyrrolidone (PVP) (%0,15(wt)) and glycerine (%0,8(wt)). Currently, these waste water streams are treated by an external company. Within this project which is designed to establish totally new it is aimed to hire a company to evaluate the possible process option to re-use the water and NMP in the process that reduces both purchase costs for NMP and disposal costs for waste water. If this project has not be prepared, 13,263,599\$/year money would be lost to buy NMP instead of recovering NMP by the established company.

In USA, legal restrictions are arranged to decrease CO₂ emission of organic compounds. Due to regulatory concerns, heavy ends (glycerine and PVP) showing up at the end of the separation process, are given to the municipality.

For this project there are three alternative processes in literature. Most suitable process has been chosen to design by using ChemCAD Simulation program. In chosen process, it is planned to recover NMP by evaporation and vacuum distillation units. Vacuum distillation is very advantageous to prevent PVP decomposition and decrease the boiling point of the components. At the end of the design simulation result shows pure NMP (99.9 w% NMP, < 0.05 w% water, < 0.1 w% glycerine) is recover to feed the membrane production process.

One of the most outstanding features of the designed process is that it is environmental benefits. Waste is not formed during the process and carbon dioxide (CO₂) emission during the process is very low quantity.

In order to understanding profitability of the project economic analyses is made for before and after the project. Based on the discounted (MARCS) profitability analysis with project life of 10 years, payback period is 1.4 years and the net present value of the project is \$ 22660000 is calculated with using Capcost program.

To conclude designed process is highly profitable and environmentally friendly.