Potential of Potash Recovery Employing Electrodialysis(ED) Technique from Distillery Effluent

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Sugarcane is one of the major cash crop of north-western and central part of India. Distillery industry coupled with sugar industry provides an economic and social infrastructure to the rural economy. The byproduct of sugar industry known as Molasses, utilized as raw material for the production of ethanol. The ethanol is a major source of beverages, biofuels and organic solvent production. It generates a large volume (approx. 8-10 L/L) complex, highly colored and concentrated organic stream alongwith high concentration of total dissolved solids as spent wash, which is a great concern as for treatment and disposal. Waste management and resource recovery has become a major task for large volume effluent generating industry to achieve long term sustainable economic development.

The characterization of spent wash shows a high concentration of potassium up to 8-10 g/L. High level of potassium concentration in the spent wash provide a way for economic utilization of the effluent. Several conventional technologies have been reported so far in recovering the potash from spent wash using incineration, ion exchange and chemical precipitation. These are having several disadvantageous in respect to high energy consumption, economically nonviable and less environmental significant. Presently, most of the industries depend on membrane processes alongwith anaerobic digestion techniques for the treatment of spent wash. However, the effluent is rich in potassium which can be recovered in the form of potash for its usage in agriculture production, as fertilizer.

In the present study, desalination experiments were carried out for nanofiltration membrane (NF) treated effluent, containing the concentration of potassium upto 6,000 mg L^{-1} and electrical conductivity (EC) upto 28 mS cm^{-1}. The reject stream after the Nano filtration treatment was passed as feed through the Electrodialysis (ED). The main objective of the study is to separate the feed stream into dilute and concentrate stream with the aim of generating a highly saline effluent. A laboratory scale electrodialysis stack (mega EDR-Z) containing eleven cation exchange membranes and ten anion-exchange membranes of 64 cm^2 effective area was investigated for potassium removal. Two stream generated during the process one is the concentrated brine and the second one is the deionized effluent. The influence of applied voltage (10, 15, and 18 V) on removal efficiency was also examined. From these analyses, the potassium removal up to 92, 96 and 97 % has been observed at operating time of 120, 90 and 75 min, respectively. Similarly, the salinity removal upto 83, 95 and 97 % were observed. A desalinated effluent i.e. the dilute stream with conductivity less than 1mS cm^{-1} and potassium level less than 150mg/l was generated. It is concluded that the increases in the voltage led to salt and potassium separation. This is due to the increase in current induces migration movement of all the dissolved ions in the process solutions. So, with the addition of an ED system with NF, a highly concentrated brine stream can be generated that can be further subjected to advance electrochemical process for potassium separation and crystallization.

Keywords: Electrodialysis, Potash Recovery, Spent wash , Ethanol Production

