H_2SO_4 RECOVERY FROM THE GOLD MINING EFFLUENT BY DIRECT CONTACT MEMBRANE DISTILLATION

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EXTENDED ABSTRACT

The importance of the gold industry is incontestable, contributing to the advancement in different economic and technological sectors. Among its beneficiation stages, the pressure oxidation process (POX) stands out being responsible for releasing the gold occluded in sulfated matrices, therefore favoring its recovery in the succeeding stages. However, significant amounts of wastewater are also generated, composed by high acid and heavy metals concentrations. Usually, alkalinizing agents are used to treat these effluents by the neutralization and precipitation processes (FU; WANG, 2011). However, these techniques contribute to solid waste generation and the acid solution is not recovered, favoring water and soil pollution if not effectively disposed. In this way, the acid solution reclamation can be an alternative to reduce the negative environmental impact caused by gold mining activities. The membrane distillation process (MD) is presented as an alternative for the certain elements and solutions concentration. In these processes, the driving force for mass transfer is a vapor pressure difference across the membrane allowing only the vapor passage, thus concentrating all non-volatile compounds (DRIOLI *et al.*, 2015). There are four distinct MD configurations, and among these, direct contact membrane distillation (DCMD) stands out due to its operational simplicity, lower power consumption, and lower propensity to fouling when compared to the conventional membrane separation processes (DRIOLI *et al.*, 2015). In this context, this study aimed to separate and concentrate the acid solution from the gold beneficiation effluent applying the DCMD while evaluating the permeate flux throughout the test.

Experiments were carried out in a lab-scale DCMD module consisted of a flat-sheet polytetrafluoroethylene (PFTE) membrane with an effective area of 4.2×10^{-3} m². A wastewater sample collected after the pressure oxidation process, containing 21.4 mg/L of sulfuric acid, was used as feed for the DCMD process, which was maintained at a constant temperature of 60 ± 1°C. Distilled water was used in the permeate tank, which was kept at 20 ± 1 °C with the aid of a chiller. Feed and permeate recirculation velocity were maintained constant in both tanks, corresponding to 0.14 m/s (Re = 1292), and the tests were conducted until a recovery rate of approximately 70%. Feed and permeate pH and conductivity (μS/cm) were monitored at regular intervals of 20 min. A diagram of the system used is shown in Figure 1.

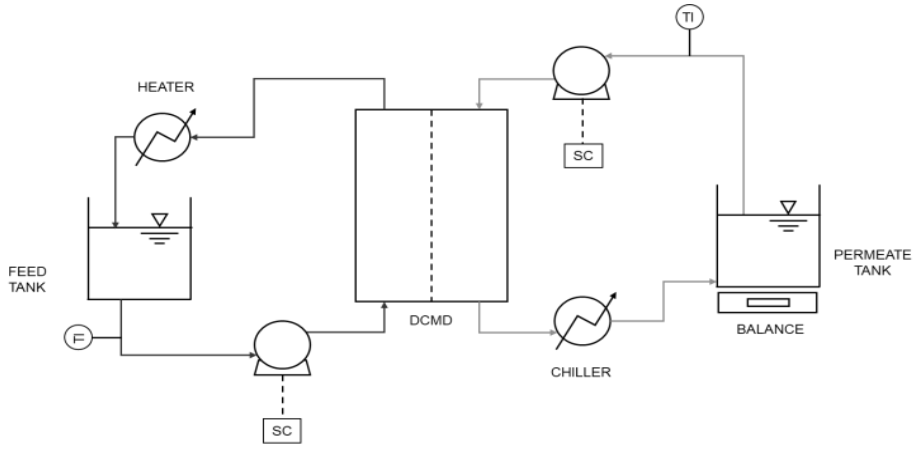

Figure 1 – Schematic diagram of the lab-scale DCMD system.

Up to 10% recovery rate the flux increased due to the establishment of a steady state regime. From there, the permeate flux remained relatively stable until a recovery rate of 52% as demonstrated in Figure 2. The variations in permeate flux observed was associated to the feed and permeate temperature variation. Additionally, it is observed that sulfuric acid concentration in the feed compartment increases along with the recovery rate, which demonstrates the direct contact membrane distillation effectiveness for acid concentration and recovery. The final sulfuric acid concentration achieved was 96.2 g/L, equivalent to a concentration factor of 4.5.

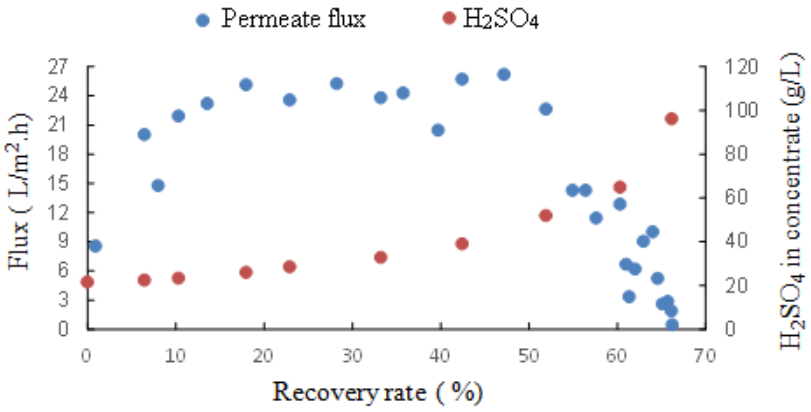

Figure 2 – Permeate flux and sulfuric acid concentration throughout the process.

KEYWORDS: Gold; Direct contact membrane distillation; H_2SO_4 recovery

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