Effect of temperature in Ammonia air stripping

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Waste waters containing ammonia are a serious environmental problem. The process of enriched uranium reconversion in the fuel cycle requires the use of ammonium compounds in the production process of ammonium tricarbonate and uranila (TCAU), which generates wastes containing ammonia in a concentration disallowed for discharging.

Many processes remove ammonia by oxidation. Nevertheless this is strongly inhibited by the presence of oxidable organic compounds in aqueous solution. Under these conditions, the use of oxidative processes is inefficient. On the other hand, the elevation of pH to the region of free ammonia (NH_3), and the condition met in the wastes of INB enable the use of air stripping technique for ammonia removal [1-3].

In this project, the treatment of streams of carbonated water originated from UO_2 dust production process is investigated. The sample was received after the elimination of ions of uranium complex which was contaminated by membrane nanofiltration. Ammonia removal was evaluated as a response to factors air flow and heating. The possibility of heating with a domestic commercial solar heater was also studied preliminarily.

The two levels of complete factorial design of experiments were performed with temperatures of 25 and 45°C. Air flow (ml/min) was equal to 0 or 200. Statistical analysis indicated that in these ranges, temperature is the main factor to ammonia removal. Airr flow and combined temperature have only minor relevance. However, factor air flow alone, in the range of this design, was not relevant to removal.

Another design of experiments was performed applying response surface technique to investigate the minimal conditions to ammonia removal take place. In this turn, 13 experiments were performed with air flow ranging from 130 to 250ml/min and temperatures from 35 to 60°C. The Figure 1 presents the results of these experiments in a 3D graph.

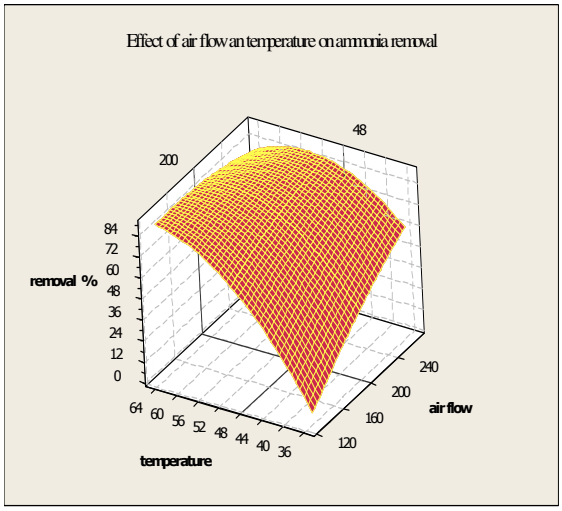

Figure 1: Effect of temperature and air flow on ammonia removal.

Results confirmed that air flow has, relatively, a minor effect compared to temperature. Relevant level of removal is achieved at least with 45°C and air flow of 200ml/min as minimal conditions.

An experiment with a solar domestic heater was also performed, adapting a 25 l container to it. The system reached 49°C, however the air flow of 300ml/min was insufficient for the almost 30 times greater volume to treat compared to those used in the previous experiments in laboratory and only 10% of ammonia was removed in 4 hours.

References

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