

# **Struvite production from source separated urine in Nepal: The Reuse Potential of the Effluent**

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Important amounts of nutrients excreted by humans are found in human urine. This provides the motivation for separating urine and recycling it, as fertilizer, back to agricultural land for food production. Urine diverting toilets have been increasingly being promoted in Nepal and more than 500 units have been installed since 2002 (Tuladhar, 2008). However, potential drawbacks to urine handling systems are the risk of ammonia evaporation and the relatively large volumes to be handled. In that situation struvite technology has been established to trap the phosphates in a solid fertilizer. Using the technology could reduce the huge volume of urine and transporting cost. However, struvite production also generates effluent. Struvite effluent reuse has significant potential benefits on both a local and global scale, such as re-circulating plant nutrients like nitrogen and potassium back to agriculture.

This thesis explores the potential reuse of struvite effluent in Siddhipur Nepal. The hypotheses being investigated are that 1) preliminary struvite precipitation prevents clogging during drip fertigation with urine and 2) that drip-fertigation with urine is superior to bucket spreading, because the ammonia volatilization is strongly reduced.

When the nutrients in effluent are beneficially utilized through irrigation some amount of pollutants discharged into our waterways can be reduced.

In this study the small plots for drip irrigation and ammonia volatilization were established. The amount of clogging was based on measurements of head loss in the tank and time of application. The ammonia volatilization measurements were collected in each hour after application.

Boric acid was used to trap the ammonia volatilized in the plots. The method was successfully used to determine that more ammonia volatilized in the plot of the bucket application for up to 2.3 times as compared with drip effluent plot. The maximum loss (11% of the applied N) was measured after application of 45 L of urine per plot while the reference plot with urine in the basin showed average 60% ammonia loss. Virtually no volatilizations were detected (on the first 6hrs) when the urine was applied to the freshly tilled soil. The results also suggest that reuse of struvite effluent through drip irrigation is possible without full clogging (only 30% decrease of flow rate).

The reuse of effluent from a struvite reactor is beneficial in terms of the nutrients that are made available and when applied through drip irrigation the loss of ammonia is reduced. In addition, the reuse of effluent can contribute towards the reduction of importing the commercial fertilizers.

**Key words: Struvite, volatilization, fertigation, clogging, effluent, drip system**