EVAPORATION OF HUMAN URINE FOR NATURAL FERTILIZER PRODUCTION

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Ecological practices such as the segregation of human urine from domestic wastewater and its posterior use in agriculture has made it possible to recuperate nutrients and minimize environmental impacts such as eutrofization of water bodies [1], and beyond that, it makes possible the reduction of industrial fertilizers consumption [2]. The objective of this work was to study evaporation as a method of volume reduction and concentration of nutrients present in human urine aiming the production of a solid fertilizer to be used as a natural agricultural fertilizer. Human urine evaporation was done in a vegetation house, where there were two reservoirs containing 3,0L of urine, and in one of them sulfuric acid was added in order to minimize the loss of ammonia by volatilization. The evaporation process consisted in the use of solar energy as heat source. The evaporation was monitored daily *in-situ* through the following parameters: pH, temperature, weight and volume. Concentrations of total nitrogen, total phosphorus and K were also monitored, before and after the experiment. Results show an increase of pH in the reservoir without acid during the beginning of the process, due to hydrolysis of urea to ammoniacal nitrogen [3], having a decrease in the last days, which indicates loss of ammonia by volatilization, due to the high value of both pH and urine temperature [4]. Analyzing nutrients concentration, it was possible to observe that the addition of acid was efficient in minimizing the loss of ammonia. The concentration of NTK in acid urine by the end of the experiment was 8,6g/Kg, while in the urine without acid it was 4,4g/Kg. The potential use of human urine as natural agricultural fertilizer is shown in table 1, which brings the amount of nutrients, in kilograms, excreted through urine by a person during one year (500L), compared with the amount of fertilizer necessary to produce 250 kilograms of grains - enough to supply the amount of calories and protein needed by an adult per year [5]. Of the 7,5 kg of industrial fertilizer necessary for culture, only one person could contribute with 6,8 kg, that is, 91% of the demand.

Table1: Nutrients in human urine and the quantity of fertilizer needed to produce 250Kg of grains/year.

	Propper (20 Kg)	**Wolgast, 1993 (500L)**	**Quantity of fertilizer needed**
Nitrogen	3,4 Kg	5,6 Kg	5,6 Kg
Phosphorus	0,4 Kg	0,4 Kg	0,7 Kg
Potassium	3,0 Kg	1,0 Kg	1,2 Kg
N + P + K	6,8 Kg (91%)	7,0 Kg (94%)	7,5 Kg

After evaporation, the average was 20Kg of residual material for 500L of liquid urine, and with a balanced concentration of nutrients such as N, K and P. It was also found that the addition of sulfuric acid minimizes loss of nitrogen in 50%. In conclusion, the evaporation was efficient, with great volume reduction, facilitating both transportation from urban areas to the fields and storage, preventing the use of great reservoirs and great areas, and beyond all, makes possible the reduction of industrial fertilizer consumption.

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