Determination of Phosphorous in Plant Food[1]

When soluble plant food containing phosphorous is dissolved in water, the P is present as the HPO_4^{2-} ion. If NH_4^{1+}, Mg^{2+}, and OH^{1-} ions are made available, a precipitate of formula $MgNH_4PO_4 \cdot 6H_2O$ forms according to the below balanced equation:

$$5H_2O \ + \ HPO_4^{2-} \ + \ NH_4^{1+} \ + \ Mg^{2+} \ + \ OH^{1-} \ = \ MgNH_4PO_4 \cdot 6H_2O$$

We will determine phosphorous in plant food gravimetrically by forming and weighing $MgNH_4PO_4 \cdot 6H_2O$ and relating the mass of the product to the mass of plant food taken.

Procedure

Weigh 10–11 g of plant food to the nearest 0.1 g and dissolve in 125–140 mL tap water. If any material remains undissolved, filter into a clean container (be sure to rinse the filter paper with a few mL of water). With the sample in a container which will hold at least 1 liter, add 150 mL of the Epsom salts solution (Epsom salts is $MgSO_4 \cdot 7H_2O$) and mix well. Slowly add, with swirling, 30 mL of 10% ammonia. Allow the solution to stand for 15 minutes and then filter through a double filter. Use two 50 mL portions of isopropyl alcohol to rinse all of the solids from the precipitation flask into the filter (the alcohol also speeds drying of the product). After all of the alcohol has drained, remove the doubled filter paper and precipitate and spread on a paper to plate to dry until the next lab period. At that time, carefully scrape the white solid into a tared container and determine the mass of $MgNH_4PO_4 \cdot 6H_2O$ to the nearest 0.1g.

Calculations

After working through the homework assignment, you should be able to determine %P and %P as P_2O_5 in your plant food sample and compare the result to the label claims.

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[1] Adapted from Solomon, S.; Lee, A.; Bates, D. *J. Chem. Educ.* **1993**, 70,410-411.

Data Page-Determination of P in Plant Food

Complete Name of Fertilizer	
Fertilizer Label Analysis	
mass of fertilizer	grams
mass of $MgNH_4PO_4 \cdot 6H_2O$	grams
%P in $MgNH_4PO_4 \cdot 6H_2O$	
g P in fertilizer sample	grams
g P_2O_5 that could be made from g P in sample	grams
% P (as P_2O_5) in fertilizer	