Studies Regarding the Obtaining of the PK Fertilizer with the Copper and Zinc Microelement

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Abstract: The fertilizers play a very important roll in the plant growing and development. The fertilizers with microelements supply to the plant the needed nutritive substances, which doesn't exist or are insufficient in soil [1]. In the present paper were studied the conditions establishment of the double pyrophosphate of zinc and potassium obtaining, respective of copper and potassium from solutions of zinc and cooper sulfate and potassium pyrophosphate. In this way was followed the variation of the mass reaction pH, electric conductance and zinc and copper separation degree, versus the molar ratio Me^{2+}: $P_2O_7^{4-}$ and versus temperature.

Keywords: PK fertilisers, double pyrophosphate of zinc and potassium, double pyrophosphate of copper

1. Introduction

The explosive growing of the world population impose like a priority the finding of the new and efficient methods, which to can assure the food necessary, proper from the quality and quantity point of view [3, 4]. One of these methods which prove his efficiency is the fertilizers with microelements use. These fertilizers supply to the plant the needed nutritive substances, which doesn't exist or are insufficient in soil.

The potassium pyrophosphate are used in special like ingredient for liquids detergents [2], for the obtaining of some electrolytes for silvering, like reagents [5] but also like PK fertilizers.

In the present paper is followed the work conditions establishment of the double pyrophosphate of zinc, respective copper and potassium obtaining. In this purpose was followed the dependence of the mass reaction pH, electric conductance and zinc and copper separation degree, by the molar ratio Me^{2+}: $P_2O_7^{4-}$ and versus temperature

2. Experimental

For the study was used the next chemical compounds: $ZnSO_4 \cdot 7H_2O$, $CuSO_4 \cdot 5H_2O$ and $K_4P_2O_7$.

In the view of the double pyrophosphate of zinc and potassium, respective copper and potassium obtaining was worked at various molar ratio Me^{2+}:$P_2O_7^{4-}$ (0.5:1, 1:1, 1.5:1, 2:1) and various temperature (25°C, 50°C, 75°C, 100°C).

The mass reaction pH and the conductance was determinate with a multy - parameter instruments Denver, 250.

The zinc and copper content from solution were analyzed spectrophotometric using an atomic absorption spectrophotometer Varian SpectrAA 110.

3. Results and discussion

In the view of the work conditions establishment of the double pyrophosphate of zinc and potassium, respective copper and potassium obtaining were determinate the molar ratio Me^{2+}: $P_2O_7^{4-}$ and the temperature of these pyrophosphate obtaining, following the varioation of three parameters: mass reaction pH, electric conductance and the separation degree of sinc and copper from solutions.

3.1. The dependence of the studied parameters by the molar ratio Me^{2+} : $P_2O_7^{4-}$ (where Me^{2+} = Zn^{2+} and Cu^{2+})

The experimental data regarding the dependence of the mass reaction pH, of the electric conductance and of the zinc and copper separation degree versus the molar ratio Me^{2+}:$P_2O_7^{4-}$, using solutions of 0,1 M $MeSO_4$ and $K_4P_2O_7$ at the temperature of 25°C, are presented in figures 1-3.
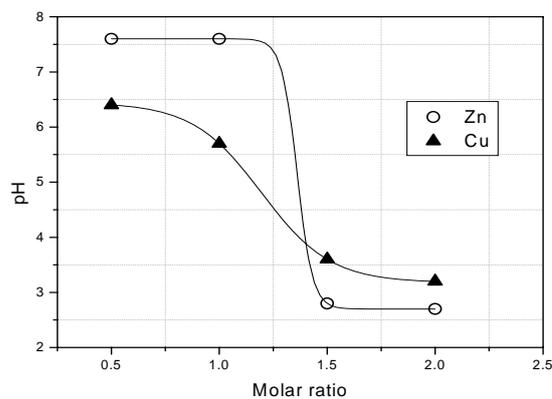
Fig. 1. The mass reaction pH dependence by the molar ratio Me^{2+}: $P_2O_7^{4-}$
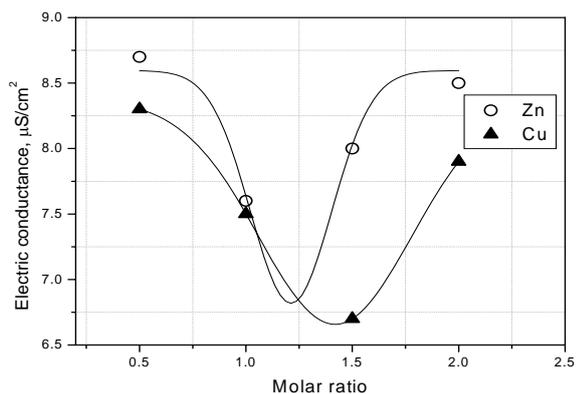
Fig. 2. The electric conductance dependence by the molar ratio $Me^{2+}: P_2O_7^{4-}$
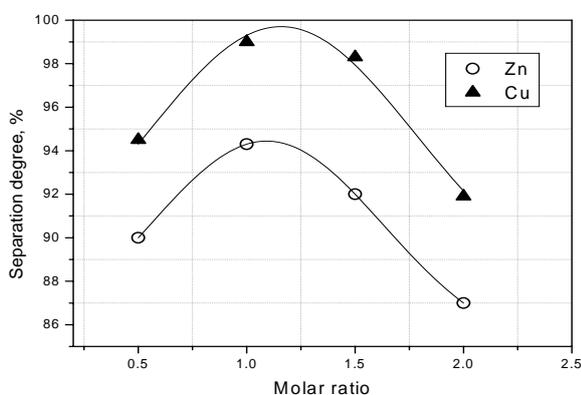
Fig. 3. The zinc and copper separation degree by the molar ratio $Me^{2+}: P_2O_7^{4-}$

From figure 1 results that between the mass reaction pH and the molar ratio $Me^{2+}:P_2O_7^{4-}$ exist a well definite interdependence, so can be said that the mass reaction pH is a control parameter of the double pyrophosphate of zinc and potassium, respective copper and potassium obtaining process. From the experimental data can be observed that the mass reaction pH have the same influence at the both double pyrophosphate.

From figure 2 can be observed that the variation of electric conductance depends also by the molar ratio Me^{2+}: $P_2O_7^{4-}$. This present a sudden decreasing until the molar ratio 1:1-1:1.25 in the case of zinc and until the molar ratio 1:1-1:1.5 in the case of copper, after which present an increasing.

Can be observed that in the domain of the molar ratio of 1:1-1:1.5 the both parameter, mass reaction pH and electric conductance present this sudden decreasing, this means that in this interval is formed the double pyrophosphate of the types: $ZnK_2P_2O_7$ $CuK_2P_2O_7$, slightly soluble.

From figure 3 can be observed that a maximum separation degree of zinc and copper can be obtained at the molar ratio Me^{2+}: $P_2O_7^{4-}$ = 1:1, both in the case of the double pyrophosphate of zinc and potassium obtaining and also in the case of the double pyrophosphate of copper and potassium obtaining.

From these experimental data can be concluded that we can work to obtain the double pyrophosphate of zinc, respective copper, and potassium at the molar ratio Me^{2+}: $P_2O_7^{4-}$ content in the interval of 1:1 – 1:1.25.

3.2. The dependence of the studied parameters by the temperature

The experimental data regarding the dependence of the mass reaction pH, electric conductance and the zinc and copper separation degree by the temperature at the established molar ratio and at the reagents concentration of 0.1 M are presented in figure 4-6.
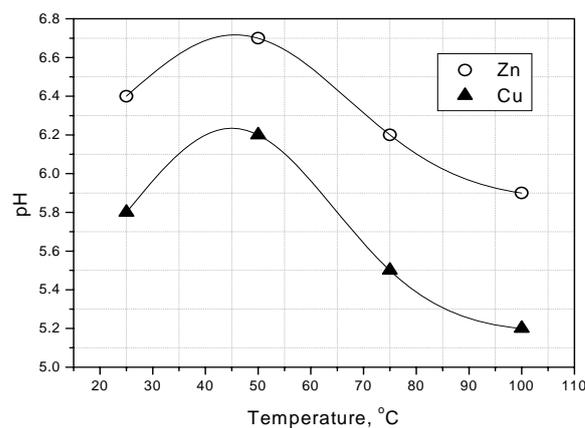
Fig.4. The mass reaction pH dependence by temperature .
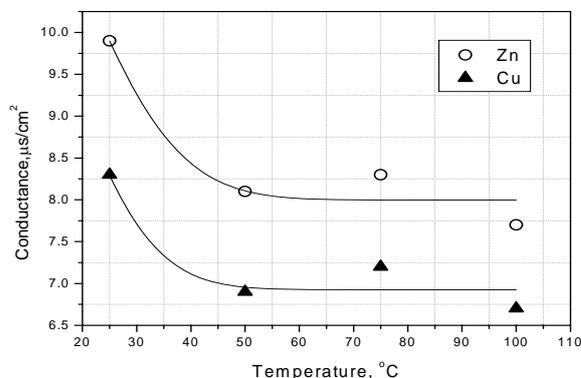
Fig. 5. The electric conductance dependence by the temperature
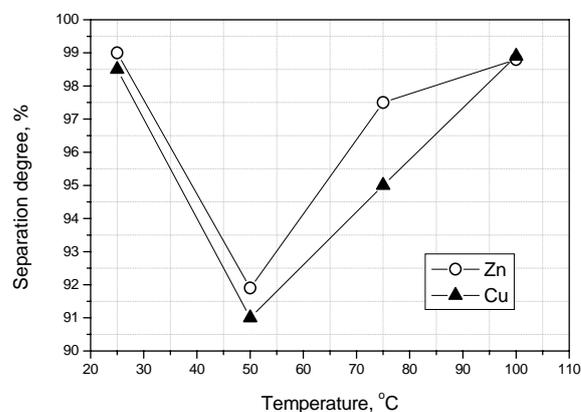
Fig. 6. The zinc and copper separation degree by temperature

In figure 4 can be observed that the mass reaction pH present an increasing in the interval of the temperature between 25-50°C, after which present a slow decreasing until the temperature of 100°C , in the case of the both metals ions. In the figures 4 and 5 can be observed again that between the mass reaction pH and conductance is a serried interdependence, when tha mass reaction present a maximum value the electric conductance have a minimum one.

In figure 6 can be observed that the separation degree in the both case is almost constant being content between 90-100%. The maximum separation degree of the metal ions is obtained at the temperature of 25 °C and 100 °C, so the optimum temperature to obtain the double pyrophosphate of zinc, respective cooper and potassium is considered to be that of 25°C, because is also most advantages from the economical point of view.

4. Conclusions

From the obtained experimental data can conclude that for the obtaining of the double pyrophosphate of zinc and potassium respective copper and potassium is necessary to work at the pH=5.5;

Between the molar ratio Me^{2+}: $P_2O_7^{4-}$, mass reaction Ph, electric conductance and metals ions separation degree there is a well definite interdependence. So can be said that the mass reaction pH and the electric conductance are the control parameter of the obtaining process of the pyrophosphates with zinc and copper;

From the experimental data results that the molar ratio for the obtaining of the studied double pyrophosphate is Me^{2+}: $P_2O_7^{4-}$ = 1 :1-1 :1,25;

The electric conductance shows that is obtained a complex pyrophosphates with slightly solubility;

The work temperature is that of 25°C.

All these data allowed the establishment of the work conditions in the view of the obtaining of the double pyrophosphate of zinc and potassium, respective cooper and potassium like PK fertilizers with microelements.

References

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