

## LABORATORY WORK NO.16

### DOUBLE SALTS

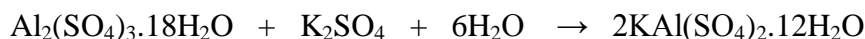
- **PRINCIPLE:** Compounds formed by two cations, eventually anions, which dissociate well in aqueous solutions are called double compounds. They are obtained by crystallization of saturated aqueous solutions which contain particular salts in appropriate ratio.

Mohr salt (diammonium iron bisulfate hexahydrate) is used in analytic chemistry.

**TASK NO1: PREPARATION OF DODECAHYDRATE OF POTASSIUM-ALUMINIUM  
SULFATE  $KAl(SO_4)_2 \cdot 12H_2O$**

- **CHEMICALS:**  $Al_2(SO_4)_3 \cdot 18H_2O$ ,  $K_2SO_4$ , ethanol, distilled water
- **AIDS:** 2 beakers 250ml, burner, stand, scales, weighing boat, spoon, rod, Büchner funnel, filter flask, suction pump, filtration paper, oven
- **PROCEDURE:** We weigh 0,01 mole of hydrate of aluminium sulfate and an appropriate amount of potassium sulfate. We dissolve particularly both substances in distilled water of 75°C (we add hot water carefully until the substance dissolves). We filter and blend both solutions, we heat the resulting solution to the boiling point and we immediately subject it to disturbed crystallization (the beaker is cooled down by hot water and its walls are rubbed by rod, the exclusion of crystals is accelerated by adding ethanol). We suck the crystals out (on the Büchner funnel) on the filtration paper weighed in advance, we dry them at temperature of 90°C. We weigh the yield (RealY).

Reaction proceeds according to equation



Substance	Mr	n(mol)	m(g)	Note
$Al_2(SO_4)_3 \cdot 18H_2O$		0,01		saturated solution
$K_2SO_4$				sat.solution
$KAl(SO_4)_2 \cdot 12H_2O$				TY
$KAl(SO_4)_2 \cdot 12H_2O$				RealY

- **CALCULATIONS :**

$$RealY = \frac{TY}{TY} \cdot 100\%$$



evropský  
sociální  
fond v ČR



MŠMT  
MINISTERSTVO ŠKOLSTVÍ,  
MLÁDEŽE A TĚLOVÝCHOVY



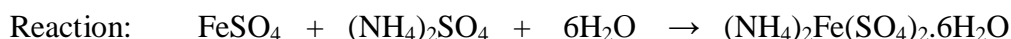
INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

where RY is the relative yield, RealY is the real yield, TY is the theoretical yield (calculated from the equation).

- **CONCLUSIONS:** Fill in the table and calculate the RY.

### TASK NO.2: PREPARATION OF MOHR SALT $(\text{NH}_4)_2\text{Fe}(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$

- **CHEMICALS:** Ammonium sulfate  $(\text{NH}_4)_2\text{SO}_4$ , heptahydrate of iron sulfate  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ , distilled water, concentrated  $\text{H}_2\text{SO}_4$
- **AIDS:** 2 beakers 250ml, burner, stand, scales, weighing boat, spoon, rod, Büchner funnel, filter flask, suction pump, filtration paper, oven
- **PROCEDURE:** We calculate from the equation how many grams of iron sulfate and how many grams of ammonium sulfate we need for preparation of 0,03 mole of Mohr salt. We prepare (at temperature of 80-90°C) saturated solutions from the calculated amounts of substances (substances are imperfectly soluble). We acidify both solutions with 5 drops of concentrated  $\text{H}_2\text{SO}_4$ , we blend them and concentrate by evaporation. We subject the concentrated solution to disturbed crystallization and we suck the crystals out on the Büchner funnel on a filter weighed in advance, we dry them at temperature of 80°C. We weigh the yield (RealY).



Substance	Mr	n(mol)	m(g)	Note
$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$				sat.solution
$(\text{NH}_4)_2\text{SO}_4$				sat.solution
$(\text{NH}_4)_2\text{Fe}(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$		0,03		TY
$(\text{NH}_4)_2\text{Fe}(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$				RealY

- **CALCULATIONS :**

$$R\cancel{Y} = \frac{\text{RealY}}{\text{TY}} \cdot 100\%$$

where RY is the relative yield, RealY is the real yield, TY is the theoretical yield (calculated from the equation).

- **CONCLUSIONS:** Fill in the table and calculate the relative yield.
- **SAFETY:** Sulphur acid is a very strong acid, it is necessary to use protective gloves, protective clothing, protective glasses, face shield. This product is caustic, perfectly soluble in water.



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**STUDENT'S SHEET No. 16**  
**DOUBLE SALTS**

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**1. Vocabulary:**

**Match Czech words with their English equivalents**

1. síran amonný	A. double compounds	1.....
2. podvojně soli	B. suction pump	2.....
3. krystalizace	C. potassium sulfate	3.....
4. Büchnerova nálevka	D. conclusion	4.....
5. síran draselný	E. exclusion	5.....
6. vývěva	F. iron sulfate	6.....
7. podvojně sloučeniny	G. double salts	7.....
8. závěr	H. ammonium sulfate	8.....
9. vyloučení	I. crystallization	9.....
10. síran železnatý	J. Büchner funnel	10.....

**2. Translate verbs into English**

vypočítat	.....
zahustit	.....
odsát	.....
zvážit	.....
vysušit	.....
rozpustit	.....
zahřát	.....
smíchat (míchat)	.....
chládit	.....
probíhat (např. podle rovnice)	.....

**3. Translate these adjectives into Czech**

saturated	.....
appropriate	.....
caustic	.....
necessary	.....
disturbed	.....



concentrated

suction

protective

soluble

particular

**4. What do this abbreviations mean – complete their full meaning**  
(not all of them are of chemical origin)

ASAP .....  
RY .....  
U2 .....  
BSRGS .....  
TY .....  
approx .....  
4WD .....  
RealY .....  
opp .....  
BBC .....

**5. Answer these questions**

What aids do you need for task 1?

What chemicals do you need for task 1?

What equation is used for correct calculation in task 1?

What chemicals do you need for task 2?

What protective means do you need when you work with sulphur acid?

**6. Complete the missing letters**

ap \_ r \_ p \_ \_ at \_  
ch \_ m \_ \_ tr \_  
c \_ \_ ce \_ t \_ \_ t \_ d  
\_ ro \_ \_ ct \_ v \_  
ca \_ \_ ul \_ t \_  
di \_ \_ ol \_ e  
c \_ ys \_ \_ l \_ iz \_ \_ \_ on