

Table 6. Kinetics of gold (III) ions (17.75 mg l^{-1}) on CAS-2 in HCl medium. The sorbent mass is 0.2 g, while the particle diameter is 0.5 mm.

Concentration of HCl, N	W_{sp} , $\text{mg s}^{-1} \cdot \text{g}^{-1}$	K_s , $\text{s}^{-1} \cdot \text{g}^{-1}$ (of the sorbent)
0.1	$1.4 \cdot 10^{-2}$	$4.0 \cdot 10^{-2}$
1.0	$1.4 \cdot 10^{-2}$	$4.0 \cdot 10^{-2}$
3.0	$1.2 \cdot 10^{-2}$	$3.6 \cdot 10^{-2}$
5.0	$0.98 \cdot 10^{-2}$	$2.9 \cdot 10^{-2}$

Table 7. An effect of metal salt impurities on the sorption of gold ions from their solution (17.75 mg l^{-1}).

Impurity concentration, g l^{-1}	Sorption time of Au^{+3} for 98%, min
$\text{Ni}^{+2} - 10 \text{ g l}^{-1} \text{ NiSO}_4$	8
$\text{Cd}^{+2} - 10 \text{ g l}^{-1} \text{ CdSO}_4$	8
$\text{Co}^{+2} - 10 \text{ g l}^{-1} \text{ CoSO}_4$	8
$\text{Zn}^{+2} - 10 \text{ g l}^{-1} \text{ ZnCl}_2$	8
$\text{Fe}^{+3} - 1 \text{ g l}^{-1} \text{ FeCl}_3$	1.5
$\text{Cu}^{+2} - 7 \text{ g l}^{-1} \text{ CuSO}_4$	5
$\text{Pt}^{+4} - 5 \text{ g l}^{-1} \text{ H}_2\text{PtCl}_6$	8
$\text{Hg}^{+2} - 0.5 \text{ g l}^{-1} \text{ Hg}(\text{NO}_3)_2$	8

to 97 % during this time. As acidity of the solution increases, not only the degree of the sorption decreases, but a certain decrease of the sorption process rate is also observed. It is worth adding that the reduction of the cations and the extraction of metallic gold on the sorbent take place regardless of the medium acidity.

An effect of metal salts impurities on the sorption studied is also determined. Table 7 presents the data referring to the complete sorption of gold (III) ions in presence of salts containing Co^{+2} , Zn^{+2} , Fe^{+3} , Ni^{+2} , Cd^{+2} , Cu^{+2} , Hg^{+2} , Pt^{+4} .

Fig. 5 shows the kinetic curves of gold (III) ions sorption on CAS-2 in presence of the metals salts studied. The data obtained shows that all impurities investigated in significantly exceeding (100 - 800 times) amounts do not impede the sorption of gold (III) ions. According to ref. [33] these metal salts should be adsorbed by the carbon sorbents. The fact that they do not impede, as found in the present investigation, suggests that the rate of gold (III) ions sorption is significantly greater than that of the metal impurities. In addition, Ni, Cd, Co, Zn ions have a less positive standard redox potential than the stationary potential of CAS-2. Therefore, these metals cannot participate in a redox reaction. Their sorption has an ion-exchange character. It is known

that the rate of the electrochemical processes is always greater than that of the ion one. This fact can explain why these impurities do not hamper gold (III) ions sorption. In presence of copper (II) and iron (III) salts the rate of gold (III) ions reduction increases significantly. A complete sorption of gold (III) ions is observed within 5 min in presence of copper (II) ions, in case of iron (III) ions this time is decreased to 1.5 min, while the time required amounts to 8 min in absence of these impurities. Such an increase of gold (III) ions sorption rate on CAS-2 can be explained by a catalytic effect: the sorbent reduces iron (III) to iron (II), and copper (II) to copper (I) ions. Iron (II) and copper (I) ions are formed at the surface layer of the sorbent and immediately react with gold (III) ions. As a reduction of gold (III) ions by iron (II) and copper (I) ions takes place at the surface layer of the sorbent, metallic gold appears there. In fact, the process of gold (III) ions sorption in presence of iron (III) salts can be represented by the scheme:

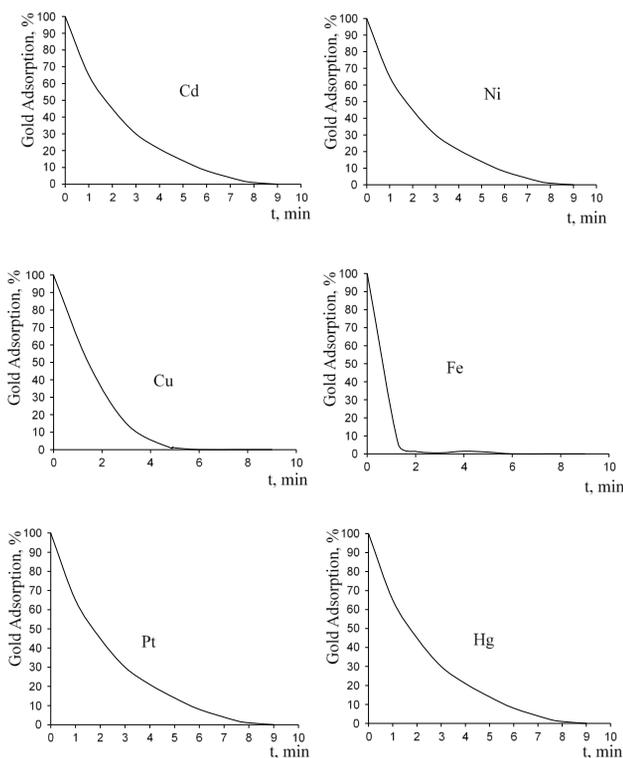
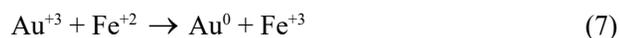


Fig. 5. A sorption of gold (III) ions on CAS-2 in presence of metal salts in 0.1N HCl (a gold (III) ions concentration of 17.75 mg l^{-1} , a solution volume of 20 ml).