Table 1. Stationary potentials of different systems in a solution of 0.1 N HCl.

| System and conditions | E, B (Ag/AgCl) |
|---|---|
| CAS - 1 on a Pt - electrode | 0.22 |
| CAS - 2 on a Pt - electrode | 0.20 |
| CAS - 3 on a Pt - electrode | 0.25 |
| $[AuCl_4]^-$ on a Pt - electrode<br>$[AuCl_4]^-$ - 17.75 mg $l^{-1}$ | 0.76 |
| Au on a Pt - electrode<br>(sorbent CAS -2 after sorption of gold on it) | 0.40 |

front edge. There a platinum electrode with a diameter of 19 mm is fastened providing the derivation of a platinum current collector. A platinum disc is pressed by a fluoroplastic clutch with a perforated front edge. An ashless filter containing the sorbent amount studied is placed there during the measurement. Then the clutch with the sorbent is wound onto the fluoroplastic cage providing a tight contact of the tested substance with a platinum electrode. The measurement of the CAS potentials was carried out under the identical conditions – it is done the same day in the same solution of 0.1N HCl for the same period of time - 10 min. The results referring to the stationary potentials of CAS are presented in Table 1.

Table 1 shows that the CAS sorbents have fairly low oxidation-reduction potentials which, depending on the brand, vary in the range from 0.20V to 0.25V (Ag/AgCl). This indicates that the CAS sorbents possess reducing properties due to the presence of reducing groups such as carboxyl, phenolic, hydroxyl, amine one on their surface [30].

The relative number of these groups depends on the carbonization conditions. Aromatic compounds which condense into polycyclic aromatic compounds (PAC) and fullerene-like compounds form with the increase of the carbonization temperature [31] durimg the initial stage of the process. Thus, not only ion-exchanging [28] but also oxidating-reducing carbonized sorbents are obtained.

The measured stationary (real) potential of $[AuCl_4]^-$ in a hydrochloric acid medium (Table 1) is equal to 0.76 V (Ag/AgCl). The potential difference between the gold (an oxidizing agent) and the sorbent (a reducing agent) is 0.51V - 0.56V. A potential difference of 0.24 V is required for the complete proceeding (99.9%) of any redox reaction [32]. The data obtained provides to conclude that there is a real possibility to reduce gold (III) ions to a metallic state. This possibility is confirmed by the potential values of the CAS sorbent after gold (III) ions sorption on them. This potential value equals 0.40 V (Ag/AgCl) in case of using CAS-2 sorbent (Table 1). The ability of CAS to reduce $Au^{+3}$ to a metallic state is confirmed by the experiments referring to the determination of the dynamic and the static capacity - gold metal is visually observed on the surface on the sorbent. Fig. 2 shows the corresponding images obtained by optical (Fig. 2(a)) and electron microscopy (Fig. 2(b)). Fig. 2(b) shows that the gold ions are reduced on the surface of the sorbent in the form of octahedra.

The effect of different factors on the process of $Au^{+3}$ sorption is studied. They refer to the concentration of $Au^{+3}$ in the solution, the sorbent mass, the diameter of sorbent, the acidity of hydrochloric acid medium and the metal ions impurities presence. The initial rates method is used to determine the values of $Au^{+3}$ sorption rate. The

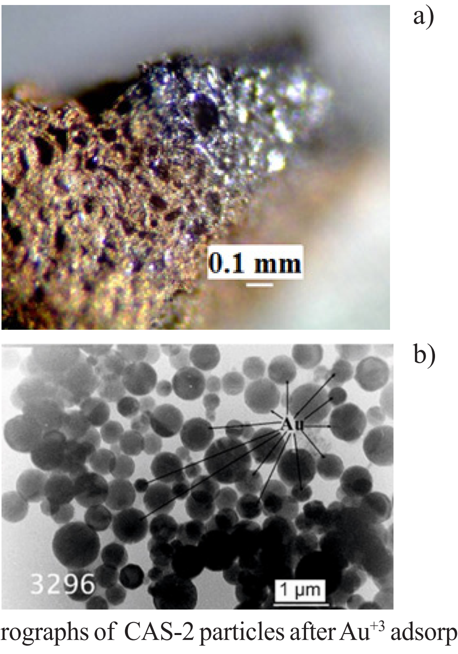

Fig. 2. Micrographs of CAS-2 particles after $Au^{+3}$ adsorption.