Morphological characteristics of fine air particulate matter collected in the suburban area

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The air quality monitoring in both urban and rural areas has revealed the ambient particulate matter as the most harmful airborne pollutant for human health while in addition to the particle composition, their size and shape are crucial for the behavior in the body. Here are presented results of the physical-chemical characterization of the submicron particles collected at the Belgrade suburban monitoring site Zeleno Brdo. Daily (24h) samples were collected by Leckel reference samplers on the polytetrafluoroethylene (PTFE) 47 mm filters in four seasons 2018/19. Particulate matter with submicron aerodynamic dimeters were analyzed for mass concentration with 0.001mg resolution and for content of about 20 elements by EDXRF technique. Additionally, selected loaded filters were dried and coated with a thin layer of gold to prevent charging and analyzed by SEM imaging in high vacuum conditions with varying magnifications (e.g., 1,000-50,000) enabling observation of fine details. Results have shown occasionally smooth or rough image of the surface with individual fine particles and their associations exhibiting a wide range of shapes. The most could be characterized as irregular and agglomerated with porous flakes, such as crustal material with well recognized spherical and rectangular shapes. Soot particles are highly aggregated mostly into chain-like structure, while the mineral dust was observed in irregular shapes with jagged edges. The secondary aerosols such as sulphates and nitrates formed in mutual interactions of smaller air particles with emitted gas pollutants appeared in the form of small spherical droplets. Typical size range of observed structures was between 100 nm to 2.5 μm, with aggregation forming larger clusters. Described results are illustrated with SEM images. Several groups of particles such as soot or carbon-based compounds (C, O, S and N), metal-rich particles (Fe, Pb, Zn, Cu, Ni, Cd) and crustal elements (Si, Al, Mg, Ca, K, Na) are recognized as the most abundant. Obtained results indicate a high degree of the secondary aerosols formation due to a long half-life of small particles in the ambient air exposed to solar radiation and available for physico-chemical interactions with present gaseous compounds and local or transboundary transported pollutants.