



Use of transition metal dichalcogenides (TMDs) in analytical sample preparation applications

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ABSTRACT

Since the discovery of graphene, nano-sized two-dimensional (2D) transition metal dichalcogenides (TMDs) such as MoS₂, MoSe₂, MoTe₂, NbS₂, NbSe₂, WS₂, WSe₂, TaS₂ and TaSe₂, which have been classified as next-generation nanomaterials resembling graphene (G) have complementary basic properties with those of graphene in terms of their practical applications. TMDs are attracting great attention due to their attractive physical, chemical and electronic properties. Despite being overshadowed by graphene in terms of frequency of use, TMDs have been used frequently in many areas in recent years instead of carbon-based materials such as graphene (G), graphene oxide (GO), carbon nanotubes (CNTs) and nanodiamonds (NDs). It is seen that the first and frequent uses of TMDs, which are classified as new generation materials, are in the fields of catalysis, electronic applications, hydrogen production processes and energy storage, but it has been used as an adsorbent in sample preparation techniques in recent years. Similar to graphene, layers of TMDs are held together by weak van der Waals interactions. The sandwiched layers of TMDs provide sufficient and effective interlayer spaces so that foreign molecules, ions and atoms can easily enter these spaces between the layers. Intermolecular interactions increase with the entry of different materials into these spaces, and thus, high activity, adsorption capacity and efficiency are obtained in adsorption-based analytical sample preparation methods. Although there are about 35 research articles using TMDs, which are classified as promising materials in analytical sample preparation techniques, no review studies have been found. This review, which was designed with this awareness, contains important information on the properties of metal dichalcogenides, their production methods and their use in analytical sample preparation techniques.