Invited lecture

Different cationic forms of (-)cytisinium in the crystal structures of its simple salts

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(-)-Cytisine belongs to quinolizidine alkaloids naturally occurring in legumes (Leguminosae). Beneficial properties of cytisine have been recognised for many centuries and cytisine extracted mainly from Laburnum anagyroides had been used in traditional medicine e.g. for the treatment of alimentary tract conditions, migraine, insomnia, asthma, and as a substitute of tobacco [1]. It has been found that cytisine, similarly as nicotine, shows high affinity and selectivity to nicotine acetylcholine receptors (nAChR), and it has been used as the model compound in the investigation for alleviation of symptoms of neurological diseases [2]. Moreover, cytisine as the agonist of nAChRs and smoking cessation drug have been employed in antinicotine therapy [3].

In the course of our studies on this alkaloid, its derivatives and salts, we have prepared, characterized by means of spectroscopic methods and determined the solid-state crystal structures of a series of simple salts of (-)-cytisine. The (-)-cytisinium cation was found in three different forms: as a monocation (protonation at N12 atom, cf. Figure 1), dication (protonation at N12 and O2 atoms) and in a form of a (3+) charged dimer, connected by a strong O···H···O hydrogen bond. The intermolecular interactions (strong and weak like common NH···O, CH···O, CH···X and rare like symmetric H bond, anion-π) will be discussed in detail, including the comparison of appropriate Hirshfeld surfaces. This method has been widely used for visualization, understanding and quantify various types of intermolecular interactions in molecular crystals. Additionally, the fine interplay between different factors, important for crystal packing modes, caused the occurrence of interesting structural phenomena: polymorphism and isostructuralism; this will be also shown in a presentation.

Keywords: (-)-cytisine; intermolecular interactions; Hirshfeld surfaces

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References