

Donor-acceptor salicylideneanilines and their keto-tautomers - synthesis and photophysical studies of luminescent materials displaying aggregation induced emission

In the modern science a lot of attention is given towards studying of the functional materials. In the area called organic electronics the functional materials are organic compounds. Unlike inorganic materials, the organic materials should exhibit convenient properties like stretchability and flexibility. Since organic compounds possess lower density than inorganic compounds, the organic electronic devices should be lightweight. Organic materials in order to be reasonable with respect to application in organic electronics, they should be easily synthesised and possess advantageous parameters. For instance, for organic light emitting diodes (OLEDs) application, the materials should exhibit decent photoluminescent properties. Unfortunately, despite significant progress of organic electronics, most of the organic compounds are too costly to be prepared on a larger scale.

In the case of certain class of compounds, namely salicylideneanilines, their synthesis is trivial, since many of these materials can be obtained in just one step from cheap commercially available reagents. Salicylideneanilines may be applied as sensors of cations and ligands to synthesise luminescent metal complexes.

Keto analogues of salicylideneanilines, that is tris(salicylideneaniline)s are also simple to prepare, but much less known and studied. These are compounds with star-shaped structure for which optical and electrochemical properties are scarcely known. The initial results indicate that these materials display improved luminescent properties over ordinary salicylideneanilines. Thanks to their star-shaped structure it is expected that they will form amorphous layers exhibiting uniform luminescence on the entire area of deposition.

Most of salicylideneanilines and tris(salicylideneaniline)s show low quantum yields in solution. That is because unrestricted rotation of the substituents in their structure combined with competing nonradiative processes significantly diminish the probability of radiative transitions. On the other hand, these materials reveal much better photoluminescence parameters in the solid state thanks to the effect called aggregation induced emission (AIE). It is the result of the restriction of the rotation of substituents around certain functional groups like double bonds or imine bonds. In order to benefit from AIE effect, however, it is mandatory to establish which substituents are the most convenient to construct such organic compounds capable of this phenomenon.

The purpose of this project will be synthesis of novel salicylideneanilines and tris(salicylideneaniline)s, where their structural modifications will allow finding appropriate strategy to increase quantum yields of these systems while preserving simple synthesis. The compounds synthesised within this work will be donor-acceptor type, hence, significant changes are expected in their photoluminescent properties depending on substituents used. Structural modifications for tuning of the luminescent behaviour will involve introducing chromophores with various conjugation level and with variable steric hindrance to affect rotation processes around the main core. Significant part of the project will be attempts to apply substituent which are capable of hydrogen bonding interactions which are expected to limit the degree of freedom of the polyconjugated systems and in turn cause the increment of the quantum yield already in solution. It is expected that thanks to these structural modifications along with the application of the AIE effect the obtained materials will demonstrate high quantum yields in solid state. It is desired that alterations of the structures of the new compounds will be reflected in tuning of the colour of the emission by either giving a pure one colour emission or emission covering entire visible spectrum (white light).