

Top-Down Synthesis of Polyvinylpyrrolidone-Anchored Iodolbenzene from Bulk Iodosylbenzene or Iodolbenzene

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Extended Abstract

The presence of oxygen atoms in the structure of iodosylbenzene (PhIO) and iodolbenzene (PhIO₂) leads to the formation of secondary intermolecular O—I bonds and tightly associated oligomeric structures with very low solubility in most organic solvents and water [1]. Most previous studies were devoted to the functionalisation of the aryl ring of the hypervalent iodine compounds with the aim of increasing their solubility and reactivity by preventing the oligomerization process [2-6]. However, no attention was paid to the decreasing the size of the hypervalent iodine compounds and its effects on their reactivity and dispersibility in organic solvents and water. In some previous studies [1,7,8], we have reported the formation of nano-structured hypervalent iodine(III) and iodine(V) compounds using triethylene glycol monomethyl ether (TEG) and polyvinylpyrrolidone (PVP) as the stabilisers. In the present study, the influence of two top-down methods on the morphology and size of iodolbenzene-PVP (PhIO₂-PVP) nanocomposites have been studied. The nanostructures were synthesised using bulk-PhIO (or iodobenzene diacetate, PhI(OAc)₂) or bulk-PhIO₂ as the starting material. The aerial oxidation of PhIO to PhIO₂, facilitated in the presence of the polymer was found to be involved in the formation of PhIO₂-PVP nanocomposites. The controlled alkaline hydrolysis of PhI(OAc)₂ in the presence of PVP was also used for the synthesis of PhIO₂-PVP nanocomposites with the intermediacy of PhIO. The magnetic stirring of bulk-PhIO₂ in water and the presence of PVP was also used for the synthesis of nanostructured PhIO₂-PVP. The solution-like suspension of the nanocomposites in water was analysed by DLS to confirm the presence of PhIO₂-PVP nanostructures. AFM and FESEM images of the nanocomposites revealed dendrimer tree-like and rod-like structures for the nanocomposites synthesised from bulk-iodosylbenzene (or iodobenzene diacetate) and bulk-PhIO₂, respectively. The main objective of this study was to synthesis nano-structured PhIO₂ with significantly increased solubility/dispersibility under aqueous and non-aqueous conditions and higher reactivity towards the oxidation of organic compounds compared to those of the bulk counterpart. Furthermore, the control of reaction conditions and the choice of starting material were found to play crucial roles in the morphology of the nanostructures.

References

- [1] S.M. Hosseini, V. Lamepour-giglou, and S. Zakavi, *Journal of Molecular Liquids*, **383** (2023): 122141.
- [2] M. S. Yusubov and V.V. Zhdankin, *Current Organic Synthesis*, **9** (2), pp.247-272, 2012.
- [3] V. N. Nemykin, A.Y. Koposov, B. C. Netzel, M. Yusubov, and V.V. Zhdankin, *Inorganic chemistry*, **48** (11), pp.4908-4917, 2009.
- [4] M. S. Yusubov, V. N. Nemykin, and V.V. Zhdankin, *Tetrahedron*, **66** (31), pp. 5745-5752, 2010.
- [5] B. Wang, Y. M. Lee, M. S. Seo, and W. Nam, *Angewandte Chemie*, **127** (40), pp.11906-11910, 2015.
- [6] M. S. Yusubov, A. A. Zagulyaeva, and V. V. Zhdankin, *Chemistry—A European Journal*, **15** (42), pp.11091-11094, 2009.
- [7] S. Zakavi and R. Jafari-motlagh, *ChemistrySelect*, **1** (15), pp. 5008-5013, 2016.
- [8] R. Jafari-motlagh and S. Zakavi, *New Journal of Chemistry*, **42** (23), pp.19137-19143, 2018.