

ABSTRACT

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Pesticides are an integral part of agricultural practices worldwide. These help prevent crops from damage caused by various pests, weeds, fungi, rodents, etc., and help increase the crop yields and consequently support farmers and the economy of a nation. Even though their use is inevitable, these are harmful for the environment since most of the pesticides are water-insoluble and composing their spray solution requires the use of volatile organic compounds (VOCs), which affect the soil, water and aquatic life. Moreover, the pesticide spray solutions consist of adjuvants that help modulate the surface activity and wettability of the formulation, whose use is again detrimental for the environment. Other issues such as increasing resistance of pests and other species against the commonly used pesticides and the presence of pesticide residues in food and food products, suggest that the composition of pesticide spray solutions need to be reconsidered. The present work is one such attempt where, the use of ionic liquids (ILs) is considered for composing the pesticide spray formulations to evade the use of VOCs and adjuvants, since ILs could act both as solubilizers and wettability modulators of pesticides. ILs are a class of compounds consisting of an anion and an alkyl chained cation, that are liquid below room 100 °C and by choosing the correct pair of cation and anion, their surface activity, solubility, viscosity, and other physicochemical properties can be altered as per the need of the reaction. In the first study, the binding studies of an insecticide nitenpyram (NTP) and the IL PyrC₆Br were performed using different spectroscopic, computational and surface tension measurements and the wettability of NTP was seen to augment with the IL. In the second study, interaction of NTP was done with two imidazolium based ILs C₄mimCl and C₈mimCl, where the later one possessed better interaction with NTP. In the third study, aqueous nanoemulsions (NEs) were formulated using PyrC₈Br and PyrC₁₂Br and Tween 20 and it was observed that NE consisted of PyrC₈Br-Tween20 and the insecticide lambda-cyhalothrin (LCT) loaded to it possessed higher surface activity and wettability. In the fourth study, the solubility of an insecticide cypermethrin (Cyp) was evaluated using C₄mimCl and C₈mimCl where it was observed that C₄mimCl enhanced the solubility and C₈mimCl upgraded the wettability. In the last study, GO and rGO were synthesized and used with the systems of PyrC₄Br and PyrC₈Br and the presence of these two nanomaterials was seen to enhance the solubility and wettability of Cyp. Thus, the present work is an attempt in the domain of agrochemicals.