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Do polymer-based adjuvants reduce airborne pesticide drift and mitigate human exposure risk?

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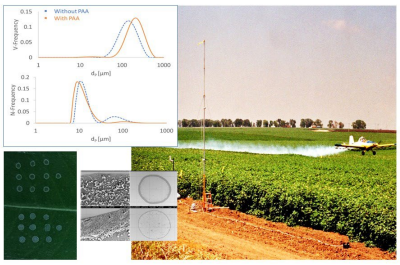

Atmospheric pesticide drift, during and after its application, is of major environmental and health concern. A common practice for reducing spray drift during applications involves the addition of chemical adjuvants to the pesticide solution. This addition is known to enhance the solution's viscosity, which upon spraying shifts its droplets size distribution to larger droplets that are less drift prone. Previous studies, that have examined the effect of adjuvants on drift reduction, mainly rely on measurements of droplet sedimentation while ignoring the presence of pesticides in the forms of small aerosols and vapor. Such forms are expected to be highly susceptible to atmospheric drift that may pose human health risk via inhalation exposure. Furthermore, changes in physicochemical properties of spray droplets (due to addition of such polymeric adjuvants) is also likely to alter their behavior and reactivity after deposition upon treated surfaces, and hence also their environmental impact.

The present study examines the effect of a polymer-based adjuvant on airborne-pesticide drift during application (primary drift, PD) as well as on the fate of deposited spray-droplets.

Surprisingly, active air sampling during two field applications indicated higher primary drift of airborne pesticides in the presence of adjuvant in the spraying solution. Measurements of droplet size distribution in wind-tunnel experiments showed that while adjuvant addition resulted in a desired shift of the volumetric distribution towards larger droplets, it also led to a significant increase in the number concentration of fine droplets. Such trend explains how addition of polymeric adjuvant can yield both a reduction in sedimenting drift outside treated areas, and an enhanced airborne primary drift, as observed here.

The adjuvant's effect on pesticides' post-application fate was evaluated by testing its impact on photolysis and evaporation rate of a common fungicide deposited films. Controlled laboratory experiments reveal that the adjuvant presence alters film's morphology and increases the fungicide's volatilization and photolysis rates. Field data was less conclusive, suggesting a small impact of the anti-drift adjuvant on the pesticide secondary drift.

Overall, this study demonstrates the complex effect of chemical adjuvants and the urgent need to further explore and understand their environmental impact.