Release of metal nanoparticles from paints during contact with water

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In this study, metal nanoparticles (nAg, nZnO and $nTiO_2$) released from to painted boards under various aging and aqueous chemistry conditions where characterized for size and concentration by analyses of the aqueous wash samples by Inductively- Coupled Plasma Mass Spectrometry in single particle mode (spICP-MS). Engineered nanoparticles (ENPs) are being used extensively in a variety of industrial and consumer products like paints and coatings to enhance its function and performance, but the fate of the nanoparticles over the paint/coating life-cycle is not well understood. Recent studies have assessed the release of $nTiO_2$ and nAg in contact with water from painted surfaces and coatings on the basis of total metal analysis. A variety of metal nanoparticles are being used in paints, some of which may solubilize in water. spICP-MS provides simultaneous analyses of dissolved metals as well of the particle size distribution, this information is useful towards assessing the environmental impacts and risks of the nanoparticle and metal releases. The paints were custom-made with well characterized nAg, nZn or $nTiO_2$ as the only metal nanoparticles incorporated. In addition, experiments were conducted with commercial paints. $nTiO_2$ washed out from standard testing boards on which commercial paints were applied had an approximate mean size of 120 to 160 nm with a concentration range of 1 to 30 ng/g of dry paint (1.7×10^5 to 3.4×10^6 NPs/g of dry paint), depending on the paint, just by exposure to DI water. Wash waters that were acidic (pH 3.5 to 4, similar to acid rain) released 20 to 42% more NPs compared to wash waters that were at neutral pH 7 or basic (pH 9.2 to 9.8). Temperature Data on the released amounts from commercial and custom-made paints will be compared to provide insight on how paint composition impacts nanoparticle releases. Furthermore, for the non-commercial paints as the characteristics of particles added to the paints will be compared to those released. The estimation of ENP size and concentration released from paints and coatings can provide critical initial information and help advance analytical capabilities for understanding their fate in the environment.