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Supply chain approach to iron ore dust monitoring and remediation (Pilbara, WA)

In 2021 the ports of Port Hedland and Dampier in the Pilbara Region of Western Australia handled 900 Mt of iron ore. This ore was produced in the Hamersley's mines and transported by trains to the ports for subsequent export. Dust, which is generally considered to be particles less than 100 µm in diameter, is generated at all steps in the supply chain. Whilst all dust may have potential impacts on human health and mangroves and buildings a proportion of the dust is classed as respirable (PM10) dust, which consists of particles <10µm in diameter. In 2021, in response to the community concern with iron ore dust, CSIRO commissioned an internal study to characterise and benchmark the dustiness of the different ores and to develop targeted strategies to minimise dust impacts, without affecting other iron properties, such as stickiness during transportation. A specific concern is that that the dust in the PM10 fraction may contain significant amounts of particulates, such as free silicates which may have health implications for the workers and residents. This study provided detailed mineral and chemical characterisation of the dust generated from the railed fine ore products for 5 generic Australian ore types: Australian Channel iron Deposit (ACID), Australian Brockman (AB), Australian Marra Mamba (AMM), Australian Pilbara (AP) and Australian magnetite (AM). The dust from these fine ore products were compared to that generated from a sample of Brazilian Hematite (BH) type ore fines. The ores were evaluated for their physical, chemical and mineralogy properties, dust generating potential and understandings of the relationship between the dustiness of iron ores and their physiochemical properties. The size distributions of the railed fine ore products were determined, and a suite of analyses were conducted on subsamples of total (– 106 µm) and fine (-38 µm) dust. For all of the ores, the total dust fraction contains less Fe and more contaminants (SiO2 and Al2O3) than did the bulk ore. The fine dust fraction contained even less Fe and more contaminants (SiO2 and Al2O3) than the total dust fraction. This suggests that the iron ore dust contains more clay and potentially free silica than does the bulk ore. These findings were supported by optical and Scanning electron microscopy analyses of the samples. Dustiness measurements were made for each of the different ores (-106 µm) to investigate the relationship of dustiness of various iron ores with their physiochemical properties and assess their responses to dust suppression by the application of water sprays.

AUTHORS

P Hapugoda, S Hapugoda, G Zhao, E Ramanaidou, G O'Brien and Y Jin
CSIRO Mineral Resources