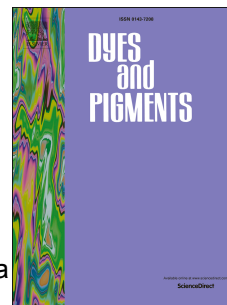


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Iron-based inorganic pigments from residue: Preparation and application in ceramic, polymer, and paint

Tanna Elyn Rodrigues Fiuza, José Flávio Marcelino Borges, João Batista Marimon da Cunha, Sandra Regina Masetto Antunes, André Vitor Chaves de Andrade, Augusto Celso Antunes, Éder Carlos Ferreira de Souza



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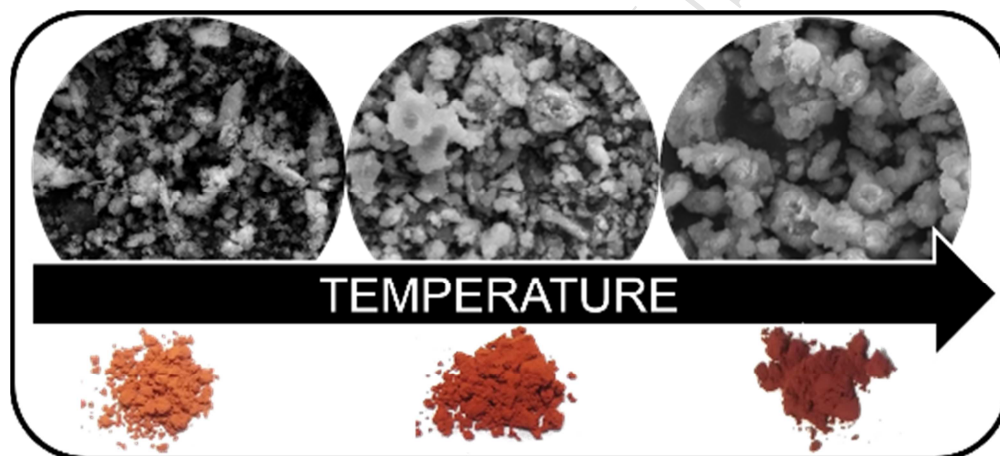
Authors: Tanna Elyn Rodrigues Fiuza^a, José Flávio Marcelino Borges^b, João Batista Marimon da Cunha^c; Sandra Regina Masetto Antunes^a, André Vitor Chaves de Andrade^b, Augusto Celso Antunes^a, Éder Carlos Ferreira de Souza^a

^aChemistry Department, Universidade Estadual de Ponta Grossa - UEPG, General Carlos Cavalcanti Avenue, 4748, Ponta Grossa, Paraná, Brazil

^bPhysics Department, Universidade Estadual de Ponta Grossa - UEPG, General Carlos Cavalcanti Avenue, 4748, Ponta Grossa, Paraná, Brazil

^cPhysics Institute, Universidade Federal do Rio Grande do Sul-UFRGS, Bento Gonçalves Avenue, Porto Alegre, Rio Grande do Sul, Brazil

Graphical abstract



Abstract

Alternative orange to dark red pigments were produced by purifying scum ashes from anaerobic treatment of domestic sewage. Scum samples collected a year apart were thermally treated at 650 °C/5 h to produce ashes, and these materials were purified to obtain intense colors, thermal stability, and reproducibility. Three different temperatures were used to calcinate the pigments. At 950 °C, the pigments achieved an intense orange color, which then became reddish and dark when the temperature was increased as a result of particle growth. All the samples presented the same crystalline phases, which is an important result that indicates reproducibility. These phases were identified by using Mössbauer spectroscopy, which revealed that the iron signature is mainly hematite (approximately 72%), and Fe²⁺ is probably related to the substitution of Ca²⁺ in the CaAl₉(PO₄)₇ phase. All the pigments presented good properties when used in ceramic enameling, but the samples produced at 1100 °C did not present a suitable size for application in polymer and paint. The samples produced at 950 and 1000 °C are more versatile and have many potential applications as an interesting alternative for the pigment industry and residue recycling, which is a problem in sewage treatment plants nowadays.

Keywords: residue, orange-red pigments, iron, environmentally friendly

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