



Establishing correlations among pore structure, surface roughness, compressive strength, and fracture toughness of ceramic water filters local to Rajasthan, India

Amrita Kaurwar Nighojkar^a, Ashish Kumar Agrawal^b, Balwant Singh^c, Sandeep Gupta^a, Raj Kumar Satankar^a, Jerry Mathew Oommen^a, Lovelesh Dave^a, Muhammad Sharif^d, A.B.O Soboyejo^e, Anand Plappally^{a,*}

^aMechanical Engineering Department, Indian Institute of Technology Jodhpur, Jodhpur, Rajasthan 342037, India, emails: anandk@iitj.ac.in (A. Plappally), kaurwar.1@iitj.ac.in (A.K. Nighojkar), gupta.5@iitj.ac.in (S. Gupta), pg201383005@iitj.ac.in (R.K. Satankar), oommen.1@iitj.ac.in (J.M. Oommen), ldave@iitj.ac.in (L. Dave)

^bImaging Beamline (BL-4), Indus-2, Raja Ramanna Centre for Advanced Technology, Indore 452013, India, email: ashishka@rrcat.gov.in

^cIndus-2, Raja Ramanna Centre for Advanced Technology, Indore 452013, India, email: balwants@rrcat.gov.in

^dAerospace Engineering and Mechanics Department, University of Alabama, Tuscaloosa, AL 35487, USA, email: msharif@eng.us.edu

^eFood, Agriculture and Biological Engineering, Ohio State University, Columbus, OH 43210, USA, email: soboyejo.2@osu.edu

Received 4 October 2018; Accepted 27 December 2018

ABSTRACT

This article discusses the characterization of local clay-organic (CO) ceramics used in the microfiltration application in India. Local clay and sawdust were the raw materials for these ceramics. Wet mix with specified volume fractions of these raw materials was hydroplastically formed to square plates, cured, and fired at 850°C. Once fired, these ceramics showed a prominent presence of silica, alumina, and oxides of iron. Quartz, potassium feldspar, and hematite are the major minerals in these ceramics. The dominance of pores orthogonal to the surface was a feature in this family of ceramics. The 500 composition of the CO ceramics is observed to have a maximum frequency of orthogonal pores. Therefore, an example of gravity-based filtration flow models of this material shaped in distinct forms is carried out to enumerate possible scaling. The surface roughness of the cured specimen plate varies linearly with the porosity of the mixture. The compressive strength shows a polynomial increase with an increase in the values of surface roughness. The fracture toughness is a linear function of the surface roughness of these CO ceramics.

Keywords: Clay-organic ceramics; Surface roughness; Porosity; Fracture toughness; Strength; Microstructure

* Corresponding author.

Presented at *Desalination for the Environment: Clean Water and Energy*, 3–6 September 2018, Athens, Greece.

1944-3994/1944-3986 © 2019 Desalination Publications. All rights reserved.