

According to the data, it can be concluded that adsorption on a dolomite sorbent with a collector additive of thionocarbamate - diisobutyl dithiophosphate ($(\text{CH}_3)_2\text{CHOC}(\text{S})\text{NHC}_2\text{H}_5:\text{C}_8\text{H}_{18}\text{O}_2\text{PS}_2\text{Na}$) occurs due to intermolecular interactions on the near-surface layer of dolomite and has more of a chemical character.

References

1. M.M. Myrzakhmetov, U.Zh. Dzhusipbekov, E.T. Togabaev, A.B. Eskozhieva Issledovanie processa sorbtzii na opytно-promyshlennoi ustanovke i razrabotka tehnologicheskoi shemy ochistki vody ot nefi // Bulletin of the L.N. Gumilyov ENU, 2012, No. 4, p. 128-131;
2. Asadpour R., Sapari N. B., Tuan Z. Z., Jusoh H., Riahi A., Uka O. K. Application of sorbent materials in oil spill management: a review // Caspian J. Appl. Sci. Res. 2013. Vol. 2, № 2. P. 46-58;
3. Jin H. X., Dong B., Wu B, Zhou M. H. Oil Absorptive Polymers: Where Is the Future? // Polymer-Plastics Technol. Eng. 2012. Vol. 51, № 2. P. 154–159;
4. Adebajo M. O., Frost R. L., Kloprogge J. T, Carmody O., Kokot S. Porous Materials for Oil Spill Cleanup: A Review of Synthesis and Absorbing Properties // J. Porous Mat. 2003. Vol. 10. P. 159-170;
5. Kolichestvennyi himicheskii analiz vod. Metodica izmerenii himicheskogo potrebleniya kisloroda v probah prirodnyh i stochnykh vod titrimetricheskim metodom / Moskva, 2016, p.21;
6. Onyango M.S., Kojima Y., Aoyi O., Bernardo Eileen C., Matsuda H. Adsorption Equilibrium Modeling and Solution Chemistry Dependence of Fluoride Removal from Water by Trivalent-cation-exchanged Zeolite F-9. Journal Colloid and Inter. Sci. 2004, 279, P. 341-350.

MICROSTRUCTURAL ANALYSIS OF POROUS MEDIA IN PACKED BEDS OF NON-SPHERICAL PARTICLES

Boribayeva A.^a, Golman B.^b

Department of Chemical and Materials Engineering, School of Engineering and Digital Sciences, Nazarbayev University, Astana, Kazakhstan

^aaidana.boribayeva@nu.edu.kz, ^bboris.golman@nu.edu.kz

Keywords: granular materials, packed compacts, DEM, packing analysis.

Abstract. Chemical reactions, adsorption, rectification, and many other processes are often performed in the industry using packed beds of cylindrical and spherical particles. The fraction of free space in a packing of particles, known as the void

fraction, has a significant impact on how fluid flows through it, how effectively heat and mass are exchanged between fluid and solids, and the rate of chemical reactions. The void fraction is a straightforward and most understandable way to describe particle packings. Although the overall void fraction is a useful parameter for evaluating particle packing, it may not fully capture the intricate microstructure of the porous space within a packed bed. Conducting experimental studies on such packings necessitates the use of high-resolution X-ray computed tomography, which is both sophisticated and expensive, and not always readily available. Therefore, computer simulations have been successfully employed by researchers to thoroughly analyze the microstructure of spherical particle packings [1,2]. However, the investigation of packing structures for non-spherical particles remains limited.

In the present study, a microstructural analysis of the porous space within packed beds of cylindrical particles was conducted. To achieve this, superquadrics were used to generate cylindrical particles of different lengths, which were then packed under gravity with random orientation using the Discrete Element Model. Voronoi tessellation was utilized to quantify the porous microstructure of these compacts [3]. The results indicate that longer cylindrical particles tend to pack more loosely due to mechanical interlocking during compaction [3, 4]. This was reflected by a higher reduced free volume of Voronoi cells and a lower median local packing density for compacts comprised of elongated cylinders as compared to shortened cylinders. These findings are valuable for optimizing the porous microstructure of compacts consisting of non-spherical particles and enhancing their transport properties.

Literature

1. Akhmetov Z., Boribayeva A., Z Berkinova., Yermukhambetova A., Golman B., Microstructural features of ternary powder compacts, Chemical Engineering Transactions 74. – 2019. - C.385-390. DOI: 10.3303/CET1974065.
2. Zharbossyn A., Berkinova Z., Boribayeva A., Yermukhambetova A., Golman B., Analysis of Tortuosity in Compacts of Ternary Mixtures of Spherical Particles, Materials, 13. – 2020. – C. 4487. DOI: 10.3390/ma13204487.
3. Boribayeva A., Iniyatova G., Uringaliyeva A., Golman B., Porous structure of cylindrical particle compacts, Micromachines.12(12). -C. 1498. - 2021. DOI: 10.3390/mi12121498.
4. Iniyatova G., Yermukhambetova A., Boribayeva A., Golman B., Approximate Packing of Binary Mixtures of Cylindrical Particles. Micromachines, 14(1). -C. 36. - 2022. DOI: 10.3390/mi14010036.