Controlled Release Zeolite Fertilisers: A Value Added Product Produced from Fly Ash

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ABSTRACT

Of 13 million tones of coal ash produced in Australia in 2003, only 34% is used in some way, with only 15% utilised in applications of value[1], while the remainder is accumulated in landfills and ash dams. This low level of ash utilisation is inevitable due to the combination of inherently high transport costs, and relatively low value products. This situation argues for more value-added utilisation of coal ash to overcome the transport cost barrier. Zeolite synthesised from fly ash for agricultural application as a controlled release fertiliser, is a technology which offers considerable advantages in terms of economic, technical and environmental performance. The Australian fertiliser market consumed 192 Kt of potassium (K) in 1999[2]. Assuming a cation exchange capacity of 3.5, this market is equivalent to 1.5 Mt of zeolite per annum, requiring roughly an equivalent amount of fly ash to produce. With Muriate of Potash (KCl, 60% K_2O equivalent) selling for $AU395/tonne in 2002[3], this fertiliser market is both a high value and high volume market, with the potential to consume significant quantities of fly ash. Studies using natural zeolites have demonstrated significant improvements in fertiliser efficiency for zeolites compared to soluble salts (Clinoptilolite is 7 – 9 times more efficient than KNO_3 in potting medium[4]). This paper examines the hydrothermal process for producing zeolites (such as Analcime, Cancrinite, Chabazite, Gismodine, and Gmelinite) from coal fly ash, including the relationship between zeolite types produced and operating conditions, desirable zeolite properties for controlled release fertilisers, optimal production conditions, and economic implications.

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