Section 2: Ceramic Investigations

TR14_212_213

R.573. Production of porous pipes

This programme, which was initially intended to supply pipes of a specific permeability for experimental purposes to the Mechanical Engineering Department, University of Tasmania, has been enlarged to exploit the utilisation of waste or low grade carbonaceous materials available from collieries. An outline of the experiments completed at this time is presented, together with an indication of the possible developments which could follow from this work.

PROCEDURE

Initially, pipes were extruded from a standard pipe-clay obtained from a local manufacturer (Humes Ltd). Subsequent experiments introduced combustible material into the clay matrix, with a view to accentuating the production of voids within the fired clay body.

The first series of pipes were made using sawdust which was followed by a second series using finely ground waste coal. The amounts of combustible material ranged from 5-35% for sawdust and 10-60% for coal, calculated on a weight for weight basis and correcting for the percentage ash in the coal.

At a 40 : 60 sawdust ratio, the volume of sawdust to clay made homogeneous mixing impossible, while with a coal to clay ratio greater than 60 : 40 the strength of the extruded pipe was the limiting factor.

In the final series of experiments (figures subsequently quoted) waste coal slurry from the Cornwall Coal Company was used after an initial benefication which reduced the ash content from 28% to 18%.

EXPERIMENTAL RESULTS

The main criteria in preliminary experiments was permeability, but it was evident that although extremely porous pipes could be made by reducing the clay to a minimum, the strength of the final product was also a limiting factor.

The coal pipes showed more promise for strength of final product, due to the two contributing factors of small uniform particle size and a high ash content of the introduced coal. In terms of permeability, a measure of the rate of flow of water through the walls of the pipes under standard conditions was found to be satisfactory for comparative purposes.

ρ values

Temperature of firing	% Coal added			
	60	40	20	0
1150° C	120	26	0.8	—
1050°	72	16	0.6	0.006
950°	73	33	0.4	0.007

The University required a permeability (ρ) of 1-1.5.

ρ values: permeability in terms of volume of liquid flow per unit area per unit time.

From the above results it is possible to conclude:

(1) That complete firing of the clay has not taken place at 950° C and the results are disproportionate due to lack of ceramic bonding;
(2) There is a progressive improvement in permeability as the carbon content is increased;
(3) There is a progressive improvement in permeability as the temperature of firing is increased.

CONCLUSIONS

In the final testing many unexplained variables were found which require further investigation. It was possible to show that a range of pipes with variable ρ values could be made.

In terms of drainage, filtering and other hydrological applications, these results show promise and indicate that this work could be extended.