

TR14-191-192

R.583. Separation of a sand and shell mixture

PART I

Three bags of water-saturated sand/shell mixture from the Rubicon Estuary, totalling about 400 lb in weight, were submitted by O. Harvey.

The shell would be used as a source of lime, if a shell concentrate containing less than 0.4 per cent silica could be made.

OBJECT

To determine the separation of sand from shell by pumping a slurry of both through a pipeline.

METHOD

Each bag was used as feed for separate tests. The first bag was used to settle down the circuit.

(1) Two tests were carried out using an open-impeller 1½-inch pump, and different lengths of 2-inch diameter pipe.

Test N1: 10 ft length of pipe plus two bends.

Test N2: 60 ft length of pipe plus three bends.

(2) The discharge from the pipeline was screened on a 2 ft x 1 ft Denver Dillon vibrating screen with a woven wire cloth with ¼-inch square openings to separate the shell from the sand.

(3) A portion of the sand from both tests was table concentrated to determine its heavy mineral content.

RESULTS

	% Weight	% Shell	% Acid insoluble	% Distribution of shell
Test N1—				
Coarse shell	14.0	88.1	11.9	62.6
Fine shell and sand	86.0	8.6		37.4
Head	100.0	19.7		100.0
Test N2—				
Coarse shell	23.6	93.7	6.3	72.3
Fine shell and sand	76.4	11.1		27.7
Head	100.0	30.6		100.0

In Tests N1 and N2 0.2% of the samples used was found to be heavy minerals. By visual examination the heavy minerals fraction consisted of zircon, ilmenite and garnet.

CONCLUSIONS

Pumping the sand and shell mixture through a longer pipeline did result in a lower sand content of the shell fraction reducing the content from 11.9% to 6.3% acid insoluble.

In R.544 work on this same material showed that screening and washing after vigorous agitation left a residue of sand in the shell. The present tests show that pumping liberates almost as much sand from shell using a 1½-inch pump on a long length of pipe.

It will be necessary to see what sort of product is made using larger pumps of a production plant before doing further test work on washing and screening, which these tests indicate will be necessary after pumping.

In the present tests screening has been used to separate a coarse product from the slurry to see how much sand has been retained in the shell. High screening efficiency was not attempted.

PART II

In order to assess the separation of sand and shell on a practical scale, Mr Harvey conducted a pumping experiment at his plant on the Rubicon Estuary using a 4-in x 3-in sand pump, and an 800-ft length of plastic pipeline.

OBJECT

To determine the separation of sand and shell under operating conditions, and using a longer pipeline than that used in previous tests.

METHOD

Bags of the shell/sand mixture from the mud bank in the estuary were dumped into a 44-gallon drum into which flowed a stream of water. The sand pump foot valve was also in the drum, and pumped a low density slurry through the pipeline.

A launder discharged onto the ground at the end of the pipeline.

The launder discharge was diverted a number of times into hessian bags. The solids were allowed to settle, the water and fine clay to soak through the bag wall and run to waste.

The sample of launder discharge was washed on a sieve to remove the loose sand then assayed. The - 60 mesh material was removed before sizing.

The bags of shell for the pump were sampled. This sample was assayed and the + 60 mesh fraction sized.

RESULTS

TEST N3	Shell feed		Shell concentrate	
	%		%	
Acid insoluble	47.8		6.6	
Sieve analysis fraction	% Wt	% Cum.	% Wt	% Cum.
- 3/4 in + 1/2 in ..	30.2	30.2	16.7	16.7
- 1/2 in + 1/4 in ..	34.0	64.2	38.0	54.7
- 1/4 in + 5 mesh ..	12.0	76.2	17.1	71.8
- 5 + 25 mesh ..	20.8	97.0	27.4	99.2
- 25 + 60 mesh ..	3.0	100.0	0.8	100.0
Composite	100.0	—	100.0	—

SUMMARY

(1) From the sieve analysis it can be seen that the pump is breaking up at least half of the very coarse shell.

(2) The acid insoluble result of 6.6% for the shell concentrate agrees with what was obtained in Test N2, but is still too high, hence additional means of shell cleaning must be investigated if the 0.4% SiO₂ maximum is to be met.