A DROP IN THE OCEAN: IS 1-3 % POLYMER REALLY ENOUGH?

GRT has been building kilometres of roads using only 1-2% of polymer depending on soil properties. We have achieved very good results in GRT geotechnical laboratories verified by the desirable outcome for our customers. But, we have been asking ourselves is 1-3% polymer REALLY enough to bind all soil particles? Can it be distributed evenly?

To answer this question, we turned to medical science using a non-invasive 3-dimensional X-ray microscopy. The instrument computed tomography using X-ray imaging in 3D, by the same method used in hospital CT scans, but on a small scale with massively increased resolution. This instrument is usually used to examine internal structure of tissue engineering scaffolds and other delicate biological samples. This method known as micro-tomography can generate 3D images of a specimen's morphology and internal microstructure with resolution down to the sub-micron level.

FIGURE 1

HIGH RESOLUTION X-RAY MICRO-CT , SOURCE: WWW.BRUKER.COM

FIGURE 2

MICRO-CT IMAGE OF A BEETLE, SOURCE: SCIENCESPACEROBOTS.COM

In the present work, small cylindrical samples were cut out of black soil stabilised using 2% polymer. We deliberately created irregular shapes on one side of the cylindrical sample to test the scanning quality. Figure 3-a shows the 3 dimensional images captured during 10 hours of slow scanning.

X-ray data were also analysed to create images showing phase distribution with different densities inside the sample. Polymer phases were clearly detected in the soil due to its lower density. Figure 3-b shows the phase distribution of polymer inside the soil sample.

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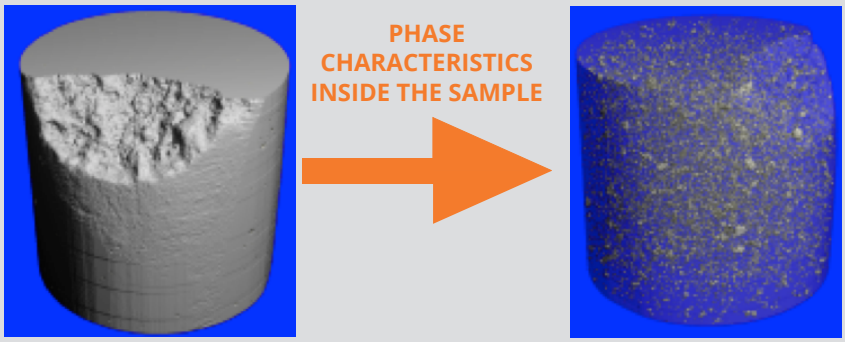
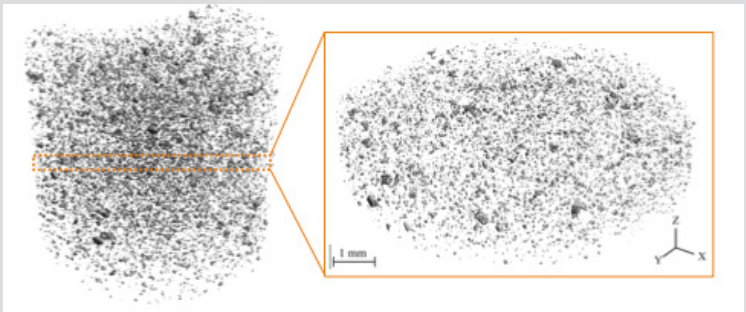
FIGURE 3



3D X-RAY IMAGE OF THE STABILISED BLACK SOIL USING 2% GRT POLYMER.

FIGURE 4



DISTRIBUTION OF GRT POLYMER IN SOIL CAPTURED USING 3D X-RAY SCANNING

These images were captured at resolution of 6 micron, but to have a clearer image of the sample, a fraction was scanned for the second time at maximum resolution of 1 micrometre. Using the image processing software, the soil phase was removed from the sample to create 3D structure of polymer inside the sample as shown in Figure 4.

These pictures clearly show that polymer is distributed evenly inside the soil, proving that small quantity of polymer is enough to bind soil samples. This is due to efficient design of GRT polymers that can easily diffuse in the soil and mix with it. Small amount of GRT polymers is enough to bind large quantities of soil because of their nano particle sizes. It seems after all , if designed and formulated properly , a few drops of polymer can work in a ocean of soil.

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