

TECHNICAL NOTE

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The Use of Clay for Soil Color Comparisons

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ABSTRACT: A method has been developed for extracting the clay fraction from soil samples and using it for soil color comparisons. A syringe press has been constructed to aid the procedure.

KEYWORDS: criminalistics, soils, colors (materials)

One procedure used for comparing soil colors involves drying the soil and sieving it to obtain a sample with a uniform particle size. This somewhat lengthy process usually provides a powdered soil sample that is suitable for color comparisons, but some soils still display a considerable amount of heterogeneity even in the finely sieved fractions.

In soils with a considerable amount of clay, the drying process produces aggregates that do not represent the natural particle sizes found in the sample. To produce a sample suitable for sieving, it is necessary to gently grind the soil to break up the clay lumps. The alternative of sieving under running water has the drawback of losing the clay fraction altogether.

Examination of a soil sample with a high clay content under a stereomicroscope reveals that the color of the bulk sample can be attributed primarily to the clay that coats the mineral grains. The procedure described below is designed to remove a homogeneous sample of clay from the soil and determine its color in a way suitable for forensic science comparisons.

Equipment

The equipment used includes: a 5-mL glass syringe with a Luer-Lok® tip; a Swinny stainless filter unit (Millipore Corp.); filter membrane disks, 0.45- μ m pore size, 13 mm in diameter (Millipore type HA or equivalent); a medium fast qualitative filter paper (Whatman No. 1 or equivalent); an ultrasonic bath; and Munsell® soil color charts.

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Procedure

Mix a few grams of soil in about 50 mL of water. Place in the ultrasonic bath for 10 to 15 min mixing occasionally to resuspend the sample. Allow the heavier particles to settle for a few minutes, then decant the liquid through medium fast qualitative filter paper. The filtrate should contain suspended clay particles.

Fill the syringe with the clay suspension and filter it through a filter membrane in the Swinny filter unit. Dry the disk in an oven at 100°C.

Discussion

The result of the above procedure is a 9-mm diameter disk of clay in the center of the 13-mm filter membrane (see Fig. 1). The presence of the white ring around the clay can affect the way a person sees the color of the clay but, since the diameter of the clay disk is the same as the diameter of the holes in the Munsell charts, it is possible to use the charts without the white ring appearing in the holes. If a direct comparison between two samples is desired, a straight edge can be cut through the disks with a sharp razor blade and the two samples butted together to eliminate any interferences from the background.

To make useful color comparisons, the clay disks produced should have certain properties. They should be flat and round, have a smooth surface, and be thick enough that the white filter membrane has no effect on the value of the color.

To insure that enough clay is deposited on the filter, it is necessary to filter enough of the suspended sample. It is difficult to do this manually as the thumbs and wrists give out before the clay disk is thick enough. To get around this, a device was made that provides a mechanical advantage by use of a screw clamp (see Figs. 2 and 3). This syringe press can apply a considerable amount of pressure, which causes the liquid to back up the syringe around the plunger. When the pressure is such that more liquid comes out the top of the syringe than is passing through the filter, there will be enough clay on the disk. A little practice and experience will help to determine when enough sample has been filtered.

It is possible that small samples or ones with little clay may need more than one syringe of clay suspension to make a thick enough disk. This is not a problem as long as care is taken to prevent any reverse pressure on the filter when disconnecting the syringe for refill. Such reverse pressure can cause the clay disk to break or wrinkle.

Drying the disk can cause it to curl, which makes color determinations difficult. To prevent this, remove the top part of the filter unit and blot away any standing water with the corner of an absorbent tissue, being careful not to touch the clay, then place the bottom part of the filter unit in the oven. The Teflon® O-ring serves to keep the disk flat while it dries.

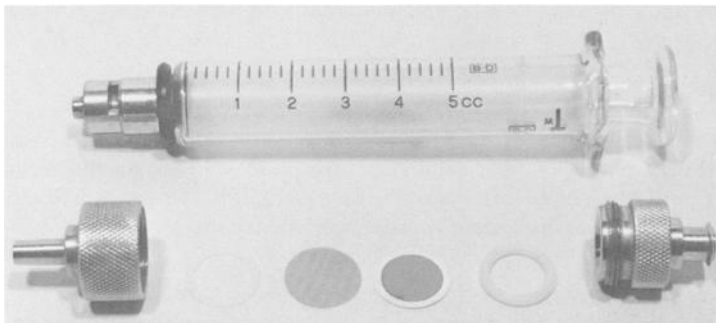


FIG. 1—Dismantled Swinny filter unit showing from left to right between the two halves, the Teflon gasket, the stainless steel screen, a completed clay disk on the filter membrane, and the Teflon O-ring.

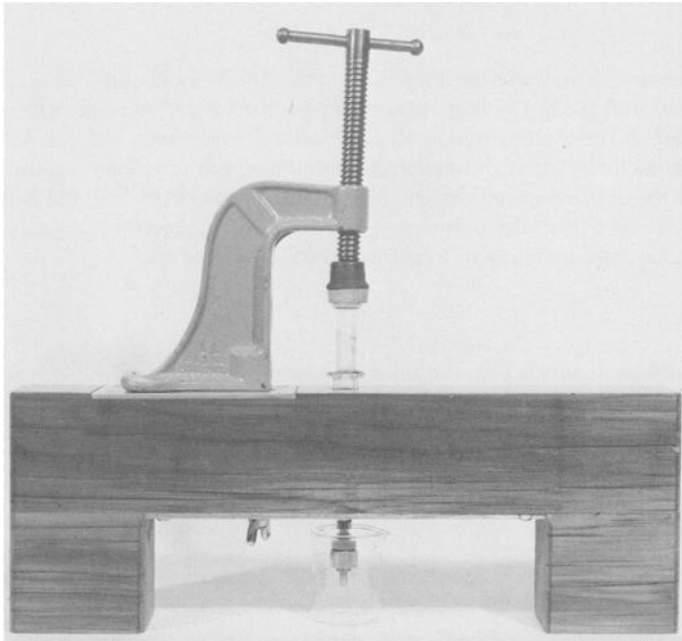


FIG. 2—Syringe press used for filtering the clay suspension.

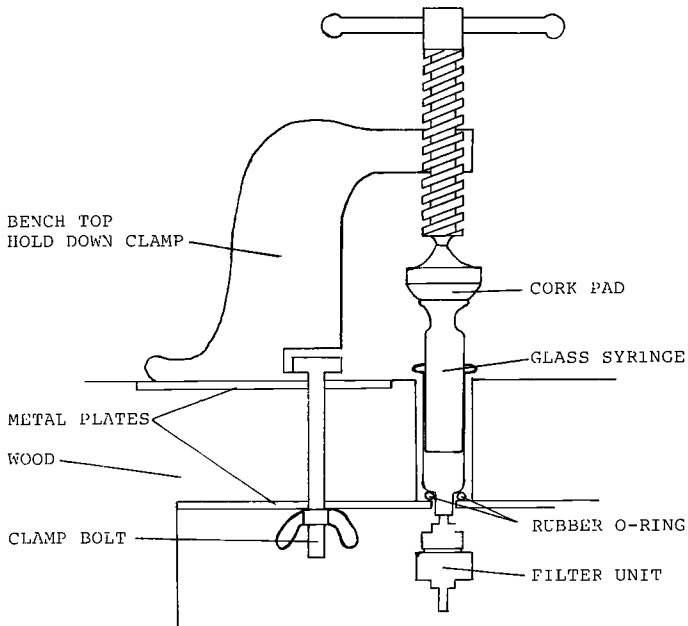


FIG. 3—Construction details of the syringe press.

Results

This procedure has been used on a few cases at the Allegheny County Forensic Science Division in parallel with the dry sieving method and has been found to provide the same conclusions regarding soil color comparisons when performed on the same samples. When using the clay disk method for soil color, it was decided to use the same criterion of color discrimination as is used for the dry sieving process. At this lab, if the color of two soils fall in the same hole of the Munsell chart, then the next step of the soil analysis procedure is performed, even if the two samples appear slightly different when side by side.

Conclusion

The clay disk procedure is easy and rapid. It provides a homogeneous portion of a soil sample for color comparisons and is capable of providing the same fraction from each sample. Using the clay fraction to determine soil color may be a good replacement for the dry sieving process.

Acknowledgments

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Bibliography

Dudley, R. J., "The Use of Color in the Discrimination Between Soils," *Journal of the Forensic Science Society*, Vol. 15, 1975, pp. 209-218.

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