

# Application Note - The Digestion of SS-1

## Introduction:

This study evaluated the effectiveness of the *DigiPREP Jr.* to digest a soil sample, **SCP SCIENCE SS-1**, as a reference material, following USEPA Method 3050b.

## Sample Type:

Soil (**SCP SCIENCE SS-1** lot SC0063618)

- Sample weight: 0.5 g.
- 4 replicates

## Supplies and Reagents:

- 1) *DigiPREP Jr.* Graphite Block Digestion System\*
- 2) *DigiPREP* Touch Screen Controller\*
- 3) *DigiPROBE*\*
- 4) *DigiTUBES*, Polypropylene flat bottom tubes, 50 ml\*
- 5) *DigiFILTERS*, 45 µm filter membrane\*
- 6) Polypropylene watchglasses\*
- 7) Nitric Acid, *PlasmaPURE* grade HNO<sub>3</sub> (70%)
- 8) Hydrochloric Acid, *PlasmaPURE* grade HCl (37%)
- 9) Hydrogen Peroxide, *PlasmaPURE* grade H<sub>2</sub>O<sub>2</sub> (30%)
- 10) Spectro Cirros ICP-OES, Spectro Analytical
- 11) Cyclonic spray chamber\*
- 12) Mini X-Flow nebulizer\*
- 13) Torch with 1.2mm alumina injector\*
- 14) Pasteur pipettes
- 15) Rubber bulb
- 16) Analytical balance
- 17) Deionized water\*
- 18) Graduated cylinder, Corning

\*Manufactured by SCP SCIENCE.

## Sample Preparation Procedure:

The sample was weighed directly in the *DigiTUBE*. After adding 10 ml of 1:1 HNO<sub>3</sub>, the tube was placed in the graphite block. The sample was refluxed at 95°C (sample temperature) for 10 minutes. The tube was then removed from the block and 5 ml of pure HNO<sub>3</sub> was added. The sample was refluxed again at 95°C for 30 minutes. This step was repeated until the brown fumes disappeared.

The sample was then evaporated to 5 ml and subsequently removed from the block. After cooling to room temperature, 2 ml of deionized water was added and 3 ml of H<sub>2</sub>O<sub>2</sub> was added dropwise while manually swirling the tube. The dropwise addition of H<sub>2</sub>O<sub>2</sub> was continued until bubbling subsides or until 5 ml of 30% H<sub>2</sub>O<sub>2</sub> had been added. The sample was placed back in the graphite block and heated at 95°C. The volume was then reduced to 5 ml (approx. 3h). After cooling to temperature, the sample was normalized to 50 ml with deionized water, filtered with a *DigiFILTER* and analyzed on the ICP.

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## DigiPREP Jr Touch Screen Controlled Heating Program:

Stage	Ramp Time (min.)	Temperature (°C)	Hold Time (min.)
1	1	95	10
2	1	95	30
3	1	95	90

## Recoveries:

Element	DigiPREP Jr. (ppm)	SD (ppm)	Certified Value (ppm)	Conf. interval (ppm)	Tol. Interval (ppm)
Ag	0.91	0.08	0.88	0.85-0.91	0.72-1.04
Al	12351	509	12163	11753-12572	9579-14746
As	19.5	0.8	20.7	19.7-21.8	14.0-27.5
B	17.1	1.2	26.9	18.5-35.2	0.0-77.8
Ba	445	7	464	448-480	359-569
Be	0.45	0.05	0.48	0.43-0.53	0.22-0.74
Ca	50612	561	50265	49052-51478	42222-53308
Cd	2.9	0.3	3.2	3.0-3.5	1.8-4.7
Co	13.3	0.5	12.9	12.5-13.4	10.2-15.7
Cr	108	8	103	97.9-109	66.6-140
Cu	399	5	403	393-416	334-472
Fe	72149	2253	72000	69728-74273	57212-86789
Hg	0.43	0.06	0.41	0.39-0.43	0.29-0.53
K	2091	123	2232	2082-2382	1257-3208
Li	14.2	0.8	14.3	12.9-15.8	6.4-22.3
Mg	9749	85	9690	9459-9920	8141-11239
Mn	742	8	737	718-756	605-869
Mo	7.9	1.4	6.8	6.5-7.2	4.7-9.0
Na	639	15	650	587-714	235-1066
Ni	59.4	1.5	59.2	57.9-60.5	50.4-68.0
P	1575	34	1552	1518-1589	1329-1775
Pb	754	11	764	749-779	665-863
Sb	6.7	1.3	5.5	4.4-6.6	0.0-12.0
Se	0.86	0.09	0.78	0.64-0.92	0.02-1.54
Sn	351	8	340	324-357	245-436
Sr	114	4	114	113-116	106-122
Ti	522	30	530	473-587	195-865
V	28.0	1.8	27.2	25.9-28.6	18.8-35.7
Zn	1140	20	1114	1078-1151	860-1369

DigiPREP Jr

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## Discussion/Conclusion:

Most digested elements are within the confidence interval for SS-1. The elements that fell outside of the Confidence Interval (As, B, Cd, Hg, Mo, Sb) are still within the Tolerance Interval. Therefore, the *DigPREP Jr.* is well suited for soil digestion.

It should be noted that, for Mo, the value is still within the Confidence Interval considering the standard deviation. As for B, the recovery is low due to the formation of the volatile boric acid under nitric acid conditions.

## References:

USEPA Method 3050b

SCP SCIENCE SS-1 certificate of analysis lot SC0063618, May 2010

DigPREP Jr.

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