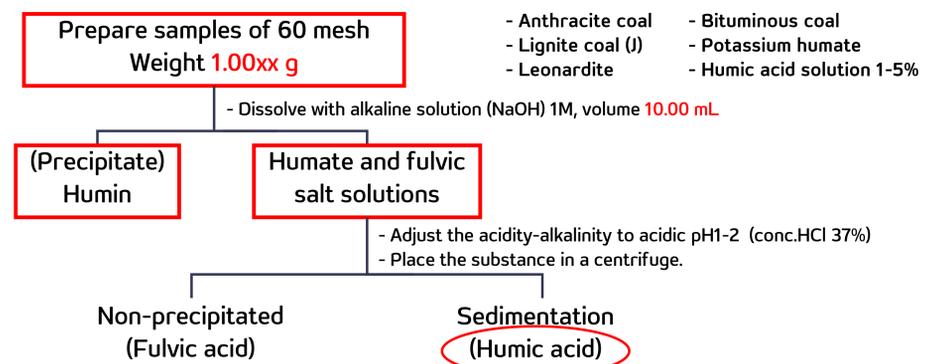


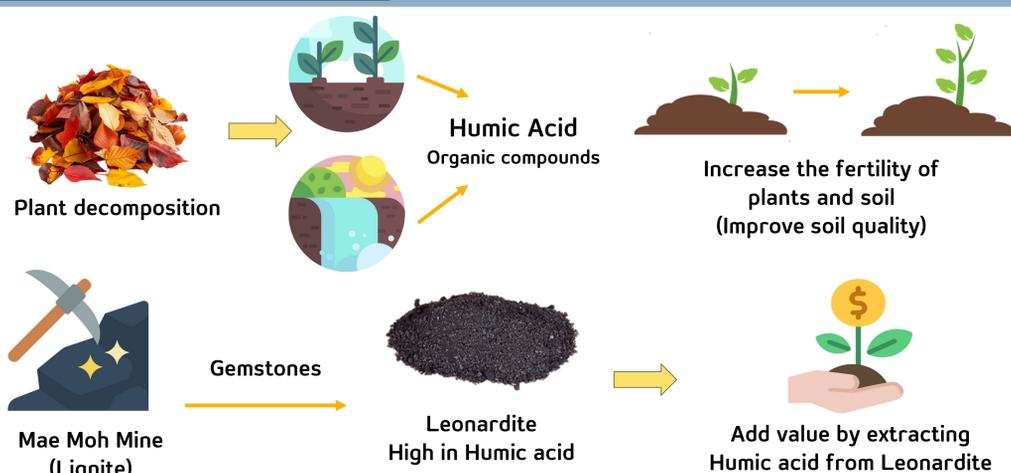
Abstract

Humic acid improves soil properties by enhancing water retention and nutrient absorption. Validation of testing methods for humic acid and organic matter in various samples is essential for accuracy determination. This study assessed six sample types using ISO 19822:2018 and the Walkley-Black method. Results showed that lignite coal J, potassium humate, Leonardite, and humic acid (1-5% solution) provided acceptable %RSD values with 1 g of sample, while anthracite and bituminous coal required 5 g. Statistical analysis confirmed significant differences between 1 g and 5 g tests. Organic matter testing in Leonardite and potassium humate showed that 0.10 g samples maintained reliable %RSD values.

Method



Introduction



Results

Table 1 Determining the %Humic acid content using 1 g sample with 10 mL of alkaline solution for different sample types.

Type	Sample	Average (X)	SD	%RSD
Solid	Anthracite coal	1.69	0.25	15.06
	Bituminous coal	8.75	1.48	16.95
	Lignite coal (J)	29.11	2.25	7.73
	Potassium humate	24.80	1.83	7.38
Liquid	Leonardite	28.27	1.23	4.34
	Humic acid solution 1-5%	2.23	0.11	4.88
Acceptance standards : %RSD < 10				%RSD < 10

Table 2 %Humic acid when using 1 g of sample with 10 mL of alkaline solution and 5 g of sample with 25 mL of alkaline solution.

Sample	1g : 10 mL			5g : 25mL		
	Average (X)	SD	%RSD	Average (X)	SD	%RSD
Bituminous coal	8.75	1.48	16.95	9.46	0.59	6.24
Anthracite coal	1.69	0.25	15.06	1.25	0.07	5.73
Acceptance standards : %RSD < 10			Above acceptance standards	In the acceptance standards		

Table 3 Comparing statistical values for 1 g of Bituminous coal with 10 mL of alkaline solution and 5 g of Bituminous coal with 25 mL of alkaline solution.

Sample	F-test		t-test	
	F Calculate	F Critical	t Calculate	t Critical
Bituminous coal 1g : 10mL	6.31	3.18	1.41	1.78
Bituminous coal 5g : 25mL	Variability is significantly different		Averages are not significantly different	

* Significant 0.05

Table 4 Comparing statistical values for 1 g of Anthracite coal with 10 mL of alkaline solution and 5 g of Anthracite coal with 25 mL of alkaline solution.

Sample	F-test		t-test	
	F Calculate	F Critical	t Calculate	t Critical
Anthracite coal 1g : 10mL	12.68	3.18	5.30	1.81
Anthracite coal 5g : 25mL	Variability is significantly different		Averages are significantly different	

* Significant 0.05

Objective

To evaluate the usability and accuracy of the testing method for Humic acid and organic matter in different samples, ensuring optimal conditions for future applications.

Scope of testing

Tested samples :



Summary of results

Table 5 Showing the suitability for determining %Humic acid in each sample type.

Type	% Humic	Sample	Ratio (g/mL)	Sample weight (g)	Alkaline solution (mL)
Solid	< 5	Anthracite coal	5 : 25	5.00xx	25.00
	≈ 10	Bituminous coal	5 : 25	5.00xx	25.00
	> 20	Lignite coal (J)	1 : 10	1.00xx	10.00
		Potassium humate	1 : 10	1.00xx	10.00
Liquid	< 5	Leonardite	1 : 10	1.00xx	10.00
		Humic acid solution 1-5%	1 : 1	10.00 (mL)	10.00

Discussion

This study evaluates the usability of humic acid and organic matter testing methods, i.e., ISO 19822:2018 and the Walkley-Black Wet Oxidation method. Humic acid analysis for samples of lignite J, potassium humate, leonardite, and humic (1-5% solution) provides acceptable %RSD, while anthracite and bituminous coal exceeded the limit due to low %Humic acid. Adjusting the sample-to-alkali ratio (5 g sample, 25 mL alkali) improved precision. Organic matter analysis in Leonardite and potassium humate, using 1 g sample resulted in dark solutions, affecting titration accuracy. Reducing sample weight to 0.10 g improved precision and is recommended.

Conclusion

- Use 5 g sample with 25 mL alkali for humic acid testing.
- Use 0.10 g sample for organic matter analysis to ensure accuracy.

References

- [1] USDA. (2016). Organic matter chemistry in agriculture. United States Department of Agriculture.
- [2] ISO. (2018). Fertilizers and soil conditioners - Determination of humic and hydrophobic fulvic acids concentrations in fertilizer materials (ISO 19822:2018).

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