

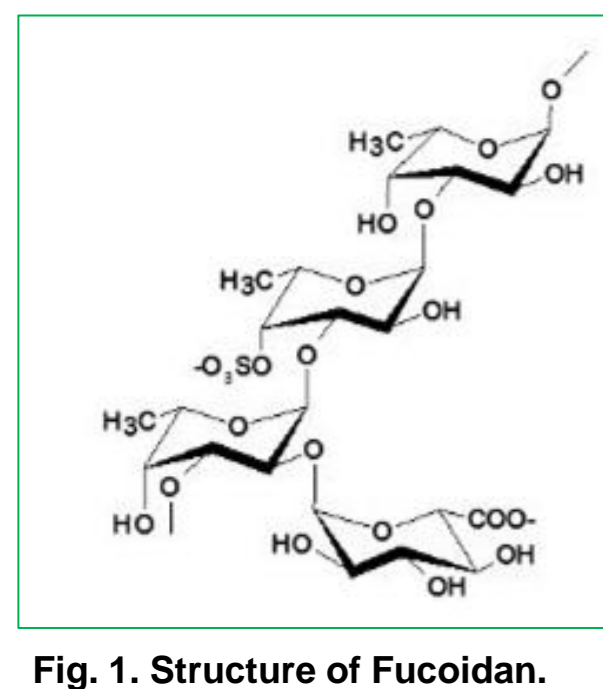


STUDY OF THE INTERACTION OF METAL CATIONS WITH FUCOIDAN

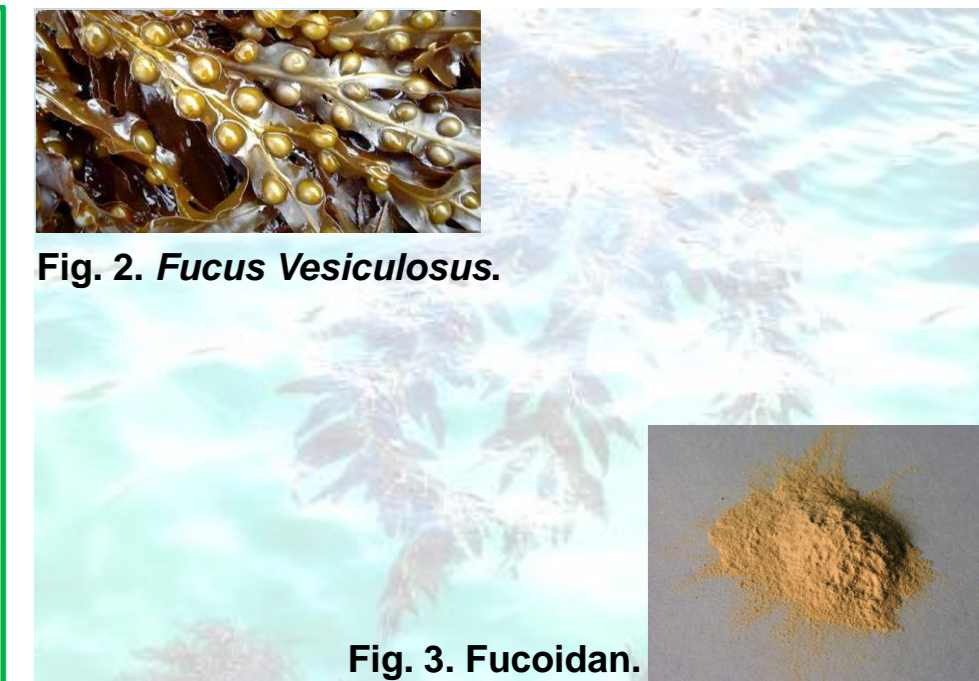
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CONTEXTUALIZATION



- **Fucoic acid** (Fig. 1, 3) is a sulfate polysaccharide mainly found in the cell-wall matrix of various species of brown algae (Phaeophyceae) and contains substantial percentages of L-fucose and sulfate ester groups [1-2].
- Brown algae are recognized by their biosorption performance and capacity to bind cations, being Fucoic acid one of the main intervenient in the metal chelation process [1].
- Quantification of lead(II) – Fucoic acid interaction is fundamental to the evaluation of *Fucus vesiculosus* (Fig. 2) potential in the context of **wastewater remediation**.
- The objective of this work is the evaluation of the Pb^{2+} - Fucoic acid interaction by potentiometric studies.



POTENTIOMETRIC STUDIES

SOLUTION

SUSPENSION

Potentiometric titration of Fucoic acid with 0.1 mol.dm⁻³ NaOH standard solution

Quantification of Fucoic acid's total acidic groups

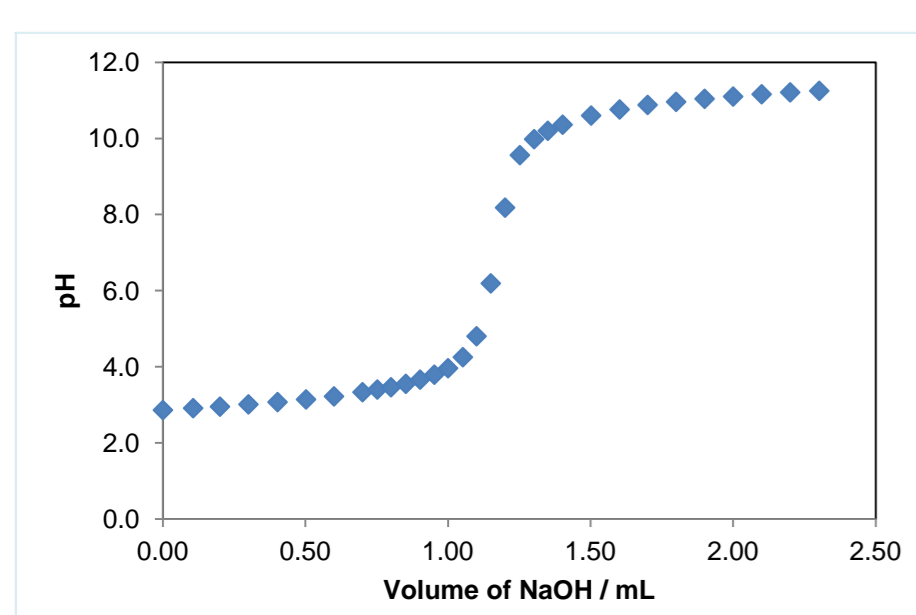


Fig. 4. Potentiometric titration curve of Fucoic acid + HCl with NaOH standard solution (I=0.1 mol.dm⁻³).

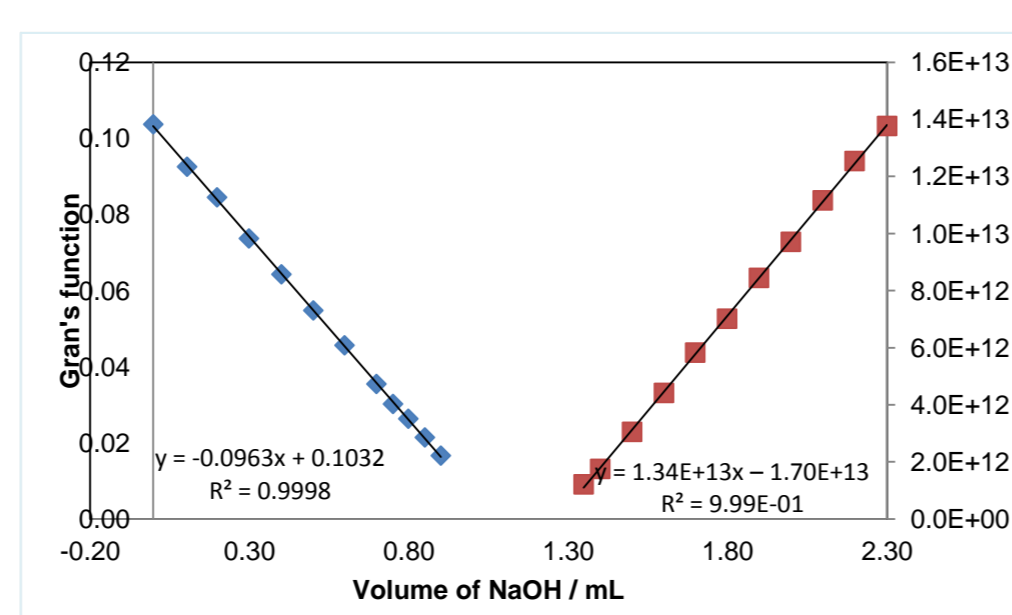


Fig. 5. Gran plot for titration curve in Fig. 4.

Gran's method

$$q(\text{Fuc}) = 1.56 \times 10^{-5} \text{ mol}$$

$$\Delta V = 0.200 \pm 0.003 \text{ mL}$$

Extrapolation
 V_{eq1}
 V_{eq2}

Surface charge determination

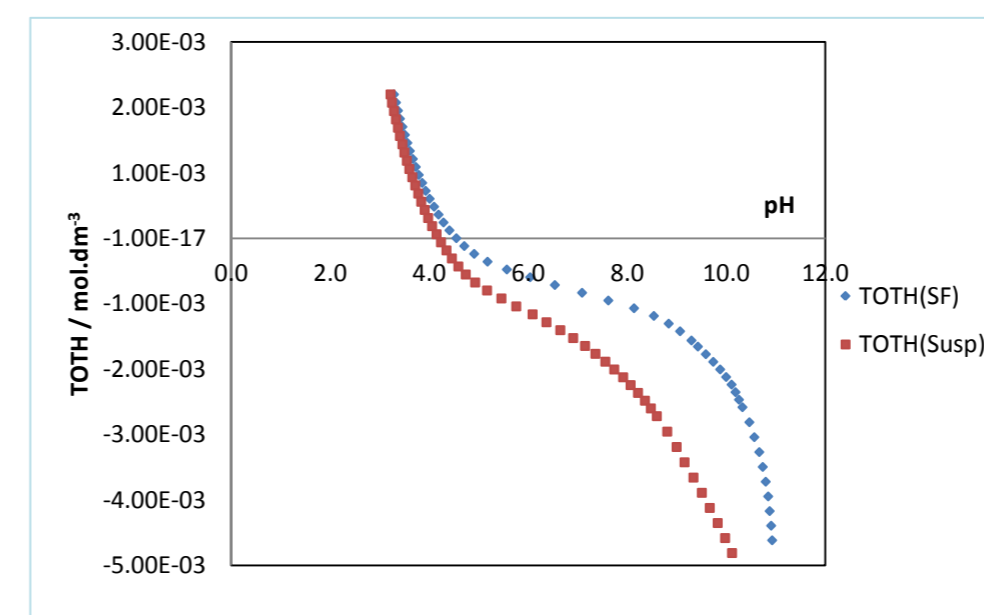


Fig. 6. Concentration of total protons added to the system (TOT) vs pH representation. (I=0.1 mol.dm⁻³)

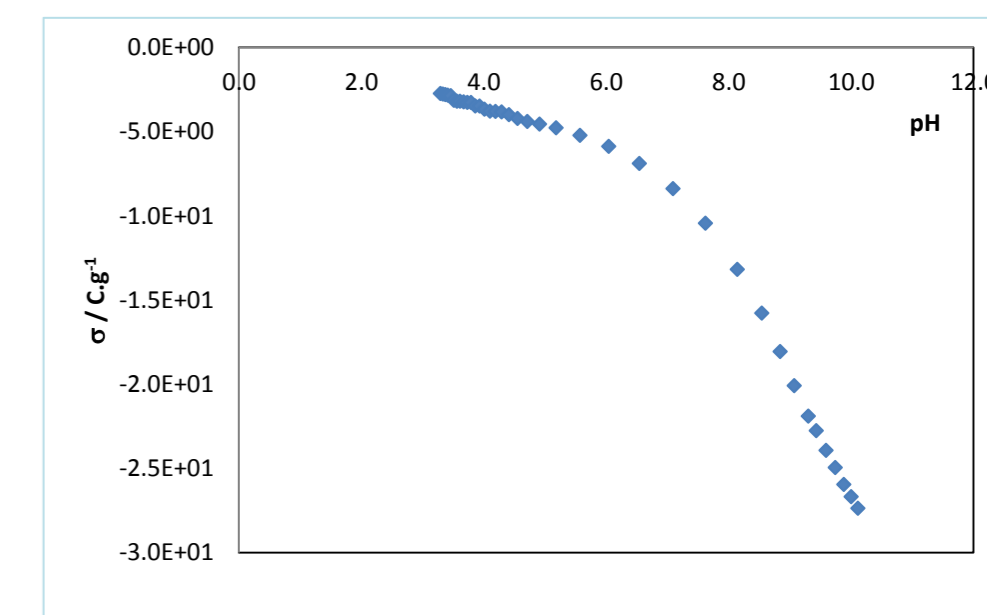


Fig. 7. Experimental charge (I = 0.1 mol.dm⁻³)

Fucoic acid surface has only negative charge (3 < pH < 10)

Potentiometric titration of Fucoic acid with a 0.06 M Pb²⁺ standard solution

Berg-Ruzic Method

$$\frac{[M]}{[ML]} = \frac{1}{CL} [M] + \frac{1}{KCL}$$

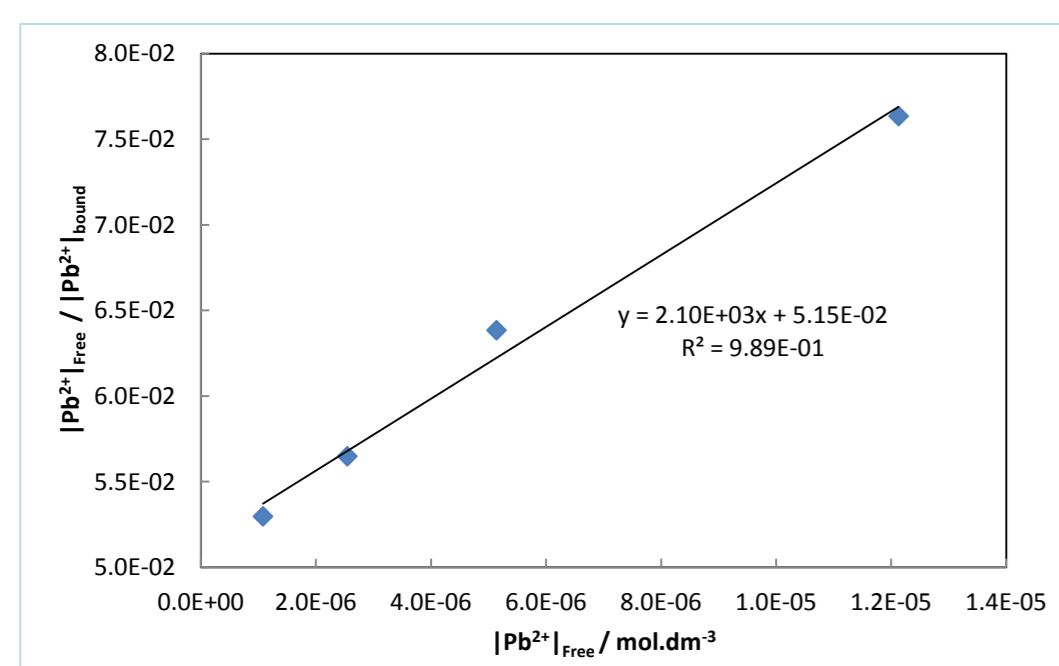


Fig. 8. Application of Berg-Ruzic method (I = 0.1 mol.dm⁻³)

Berg-Ruzic method

1:1 stoichiometry
 $C_L = 4.8 \times 10^{-4} \text{ mol.dm}^{-3}$
 $K = 4.1 \times 10^4 \text{ dm}^3.\text{mol}^{-1}$

Freundlich Isotherm

$$[Pb^{2+}]_{\text{bonded}} = K [Pb^{2+}]_{\text{free}}^n$$

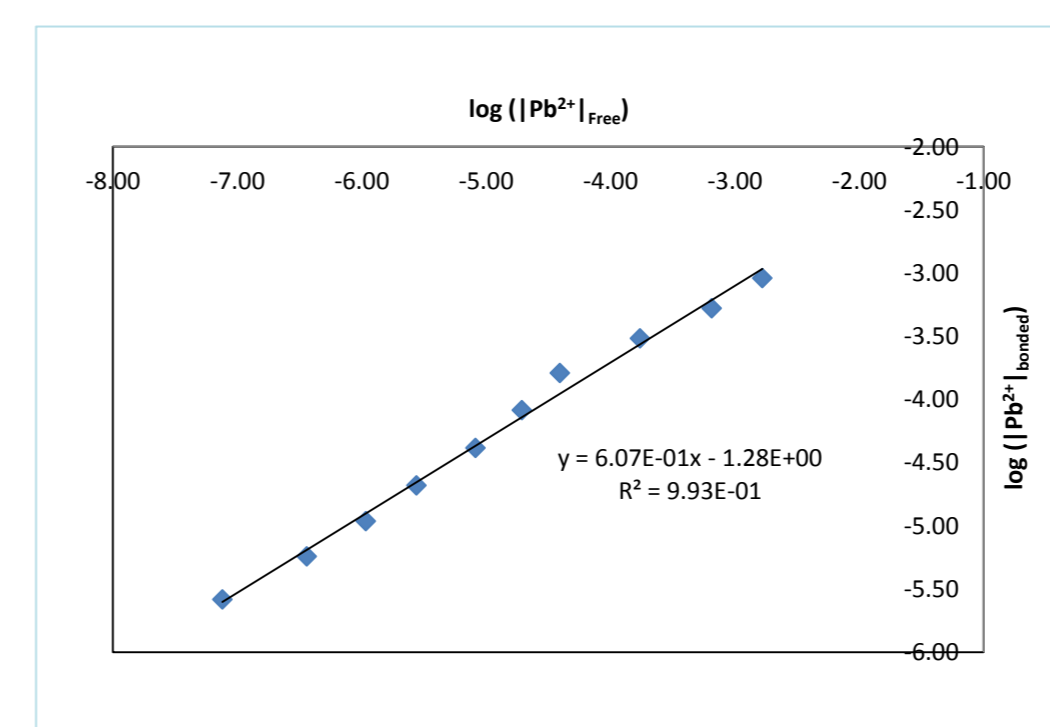


Fig. 9. Freundlich isotherm (I = 0.1 mol.dm⁻³)

$K = 5.3 \times 10^{-2}$
 $n = 1.6$

CONCLUSIONS

- Total acidic groups of Fucoic acid was quantified as 0,92 mmol.g⁻¹.
- The interaction Pb^{2+} - Fucoic acid stoichiometry was defined as 1:1.
- Fucoic acid- Pb^{2+} formation constant in aqueous solution (pH = 6) is $4.1 \times 10^4 \text{ dm}^3.\text{mol}^{-1}$ at $25 \pm 2 \text{ }^\circ\text{C}$.
- The obtained value for Fucoic acid- Pb^{2+} Freundlich coefficient is 5.3×10^{-2} at $25 \pm 2 \text{ }^\circ\text{C}$.

REFERENCES

ACKNOWLEDGMENTS

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- [1] Davis, T. A.; Volesky, B.; Mucci, A. *Water Res.* **2003**, 37,18, 4311-4330.
 [2] Wijesinghe, W. A. J. P.; You-Jin Jeon. *Carbohydr. Polym.* **2012**, 88,1, 13-20.