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TECHNICAL NOTE — BIOSTIMULANTS

Biological Digestion versus Alkaline Extraction of Kelp

How processing shapes a kelp biostimulant

How hot KOH extraction can chemically modify native kelp compounds, and why the extraction method decides which molecular fractions end up in the finished product.

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Biological Digestion versus Alkaline Extraction of Kelp

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The extraction process is an important factor determining the chemical composition and biological characteristics of a kelp-based biostimulant. Different extraction technologies do not simply determine how much material is extracted; they also determine how the original kelp matrix is broken down and which molecular fractions are ultimately recovered.

Alkaline extraction with KOH

KOH extraction is an effective method for processing kelp because strong alkaline conditions facilitate disruption and solubilisation of the kelp matrix. However, KOH treatment does not simply release the compounds originally present in the kelp. It can deliberately modify their chemical structure.

This has been experimentally demonstrated for kelp polysaccharides. Hoffmann et al. (1995) compared native kelp material with material subjected directly to hot KOH treatment. Chemical analysis showed that the predominant native μ/κ-carrageenan was readily converted toward κ-carrageenan by the alkaline treatment. This demonstrates that KOH processing can chemically transform native kelp polysaccharides rather than simply extracting them unchanged.

The extent of this modification is dependent on processing conditions. Bono et al. (2014) experimentally investigated different KOH concentrations, cooking temperatures and treatment times. Increasing KOH concentration, temperature and cooking time altered the physical properties of the recovered polysaccharides. Gel strength increased with increasing treatment severity, whereas viscosity increased when KOH concentration, temperature and treatment time were reduced. These results demonstrate that the molecular and functional characteristics of seaweed polysaccharides are directly influenced by the severity of alkaline processing. This is particularly relevant for agricultural biostimulants because the biological functionality of polysaccharides is closely related to their molecular structure, molecular weight and degree of polymerisation. Consequently, chemical modification during

extraction may alter how these compounds interact with plants and their subsequent biological activity.

Alkaline processing can also remove other soluble fractions from the original kelp matrix. In established KOH kelp processing, soluble proteins, carbohydrates and salts can dissolve into the alkaline processing liquor and subsequently be separated from the treated biomass.

These findings are important from a biostimulant perspective. A high degree of biomass disruption or extraction does not necessarily represent preservation of the original biochemical diversity of the kelp. Extraction efficiency and preservation of native molecular structure are different objectives.

Controlled biological digestion

MicroPlus Kelp is manufactured using a controlled biological digestion process rather than relying on strong alkaline hydrolysis as the principal mechanism for breaking down the kelp matrix.

Biological digestion does not leave the kelp cell wall unchanged. Instead, biological processes break down structural components of the kelp matrix through targeted biochemical reactions. The important distinction is therefore not whether the kelp is broken down, but how this breakdown occurs.

Primary experimental studies demonstrate that enzyme-mediated breakdown can effectively disrupt kelp cell walls and release substantial quantities of soluble and biologically active fractions. Rodrigues et al. (2015), for example, evaluated enzyme-assisted extraction in red, brown and green kelps. Depending on the kelp and enzyme used, substantial extraction yields were obtained, reaching approximately 48–62% in one of the species studied. The recovered fractions contained proteins, sugars, sulfated polysaccharides and phenolic compounds and retained measurable biological activities.

Practical significance

KOH extraction is an effective industrial technology and can produce biologically active kelp extracts. However, its use is not evidence that the resulting product is intrinsically superior to a biologically digested kelp extract.

The fundamental difference is the extraction philosophy.

Strong alkaline extraction uses chemical hydrolysis and elevated pH to disrupt and chemically modify the kelp matrix. Controlled biological digestion uses biochemical processes to progressively break down the matrix and release its constituent fractions without relying on strong alkaline hydrolysis as the principal extraction mechanism.

For MicroPlus Kelp, the objective is therefore not simply to maximise the quantity of kelp material solubilised. The controlled biological digestion process is designed to release a broad spectrum of kelp-derived fractions while avoiding the deliberate chemical modification associated with strong alkaline treatment.

From a biostimulant perspective, this provides a technically sound basis for prioritising the diversity and biological integrity of the recovered fractions alongside extraction efficiency, rather than assuming that a more chemically aggressive extraction process necessarily produces a superior agricultural product.

References

Bono, A., Anisuzzaman, S.M. & Ding, O.W. (2014). Effect of process conditions on the gel viscosity and gel strength of semi-refined carrageenan (SRC) produced from kelp (*Kappaphycus alvarezii*). *Journal of King Saud University – Engineering Sciences*, 26(1), 3–9.

Hoffmann, R.A., Gidley, M.J., Cooke, D. & Frith, W.J. (1995). Effect of isolation procedures on the molecular composition and physical properties of *Eucheuma cottonii* carrageenan. *Food Hydrocolloids*, 9(4), 281–289.

Rodrigues, D., Freitas, A.C., Pereira, L., Rocha-Santos, T.A.P., Vasconcelos, M.W., Roriz, M., Rodríguez-Alcalá, L.M., Gomes, A.M.P. & Duarte, A.C. (2015). Chemical composition of red, brown and green macroalgae from Buarcos Bay in Central West Coast of Portugal. *Food Chemistry*, 183, 197–207.