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Letter to the editor

Comment on Trondheim Paper

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In a recent paper by Bach et al. (Fast hydrothermal liquefaction of a Norwegian macro-alga: Screening tests, doi:10.1016/j.algal.2014.05.009) [1] up to 79% bio-oil yield is reported from the hydrothermal liquefaction of an aqueous slurry of *Laminaria saccharina* (1:10 seaweed: water). This surprising result is attributed to the effects of rapid heating. However, it appears that there are significant mass balance errors in the data as reported and that the claimed high yield cannot be accepted as reliable.

Table 1 in the paper of Ref. [1] reports the elemental analysis of the feedstock; Table 2 provides the elemental composition of three product oils, together with the oil mass recovery in each case. All analyses are stated to be on a dry, ash-free basis. Therefore it is a simple matter to compare the mass of carbon in the oil from the liquefaction of 100 g of algae with the mass of carbon in the biomass sample itself. In Table A below, we present this comparison, together with the corresponding analysis for hydrogen.

It is apparent from Table A that the bio-oils contain significantly more carbon and hydrogen than the starting material; the disparity would be even greater if the carbon and hydrogen that report to the residual solid and the aqueous and gaseous product phases were to be accounted for. The corollary of these results is that more than 100% of the energy (higher heating value) in the biomass is carried over into the bio-oil.

It is not for us to reconcile these problems but we do note that the biomass is reported to have an oxygen content of 53.03%, corresponding more to a simple sugar than a whole alga. By way of comparison, Anastasakis and Ross [2; reference 16 in the paper] report an oxygen content of 26.3% for this species of alga.

We conclude that the claims for high yield and the effect of heating rate reported by Bach et al. are not borne out by their results as presented.

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References

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Table A
Calculated masses in carbon and hydrogen in algal starting material and bio-oil products (100 g scale for convenience only), from Tables 1 & 2 in Bach et al. [1].

Source	Bio-oil yield (% dry, ash-free basis)	%C	%H	Calculated grams of C in 100 g algae: processed[a] feedstock[b]	Calculated grams of H in 100 g algae: processed[a] feedstock[b]
High HR, no cat. bio-oil	79	75.54	9.16	59.68[a]	7.24[a]
Mid HR, no cat. bio-oil	65	73.23	8.88	47.60[a]	5.77[a]
Mid HR with cat. bio-oil	67	73.46	8.48	49.22[a]	5.68[a]
Algae		**39.44**	**5.14**	**39.44**[b]	**5.14**[b]

[a] Bio-oil product resulting from hydrothermal processing of algae.
[b] Algal feedstock itself.

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