CHANGES IN THERMAL STABILITY OF LIGNOCELLULOSES WASTE AGGREGATES LONG-TERM INCORPORATED IN COMPOSITE

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ABSTRACT

The changes in thermal stability of surface-modified hemp-hurds aggregates long-term incorporated in bio-aggregate-based composites with the original ones before their integration into alternative binder matrix are compared. The effectiveness of alkaline treatment of hemp hurds compared to the raw bio-aggregates as well as in relation to their behaviour when they are long-term incorporated in the MgO-cement environment is investigated. The differences in the thermal behaviour of the samples are explained by the changed structure of hemp hurds constituents due to the pre-treatment and long-term action of the alternative binder components on the bio-aggregates. Alkaline treatment increases thermal stability of hemp hurds compared to raw sample. Also long-term incorporation of hemp hurds in MgO-cement matrix had a similar effect in case of alkaline modified bio-aggregates. The more alkali ions present in the structure of hemp hurds samples, the more ash is formed during their thermal decomposition studied by thermal gravimetry (TG) and differential scanning calorimetry (DSC)).

MATERIALS

Bio-aggregates - hemp hurds (HH)

- raw hemp hurds (reference); alkaline treated in 5M NaOH
- two samples of hemp hurds excluded from long term hardened (6 years) bio-based composites with alternative binder – MgO cement

Hemp hurds sample	Designation
Reference	RHH
Alkaline treated	AHH
Excluded reference	RHH_AB
Excluded AHH	AHH_AB

METHODS

→ TG/DSC system using a model STA 449F3 (Netzsch, Germany)
→ 10 ± 2 mg of HH sample was loaded in alumina cup to DSC/TG holder
→ a heating rate of 10 K/min from 25 to 900 °C under air flow of 60 mL·min^{-1}

RESULTS AND DISCUSSION

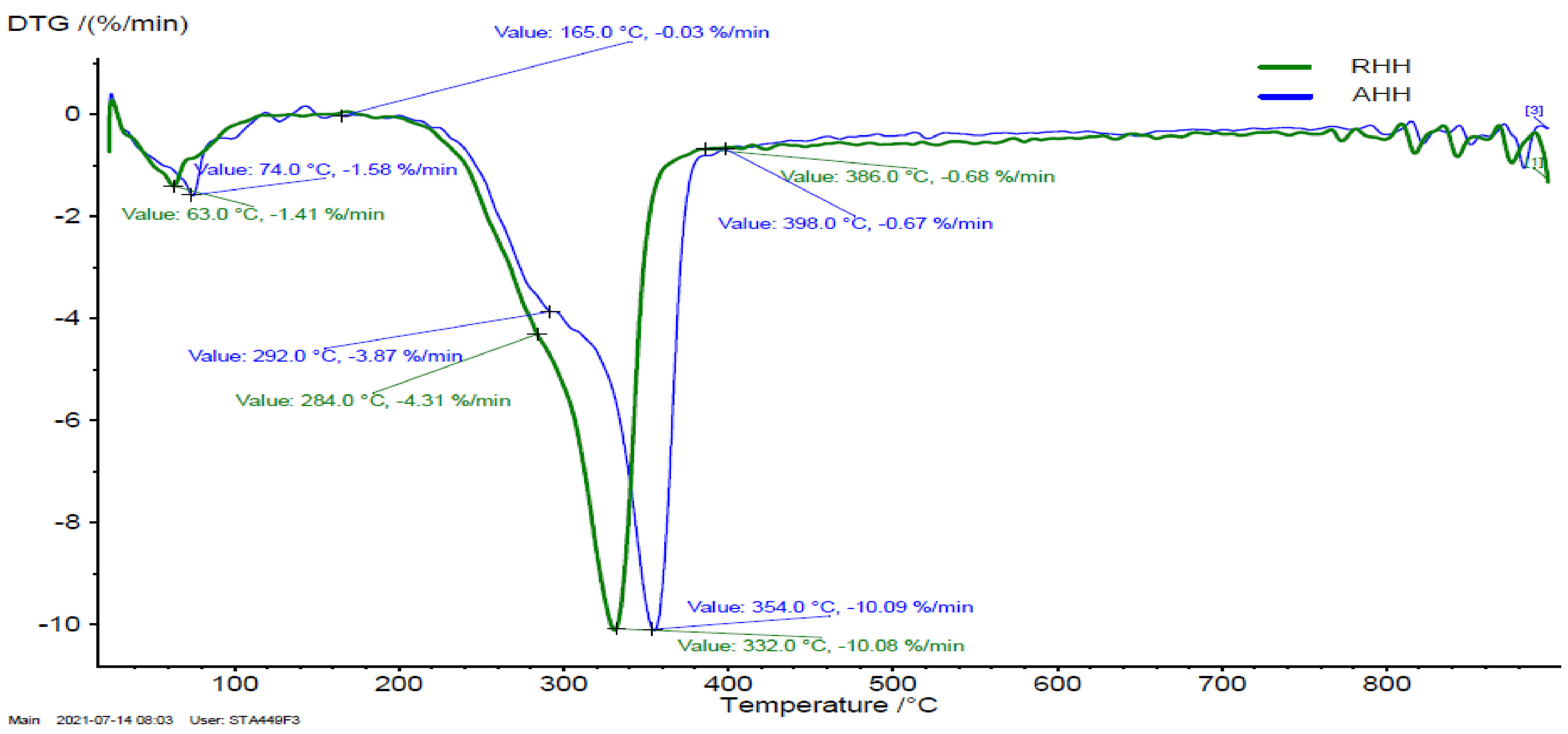

Figure 1. DTG curve of raw (RHH) and alkaline treated hemp hurds (AHH).

Table 2. Maximum temperature T_{max} of endothermic process of HH degradation and corresponding mass losses

Sample	T1max (◦C)	T2max (◦C)	Mass loss (%)
RHH	63	-	4.99
RHH_AB	59.4	93.8	7.35
AHHH	74	-	5.21
AHH_AB	74	133.7	8.97

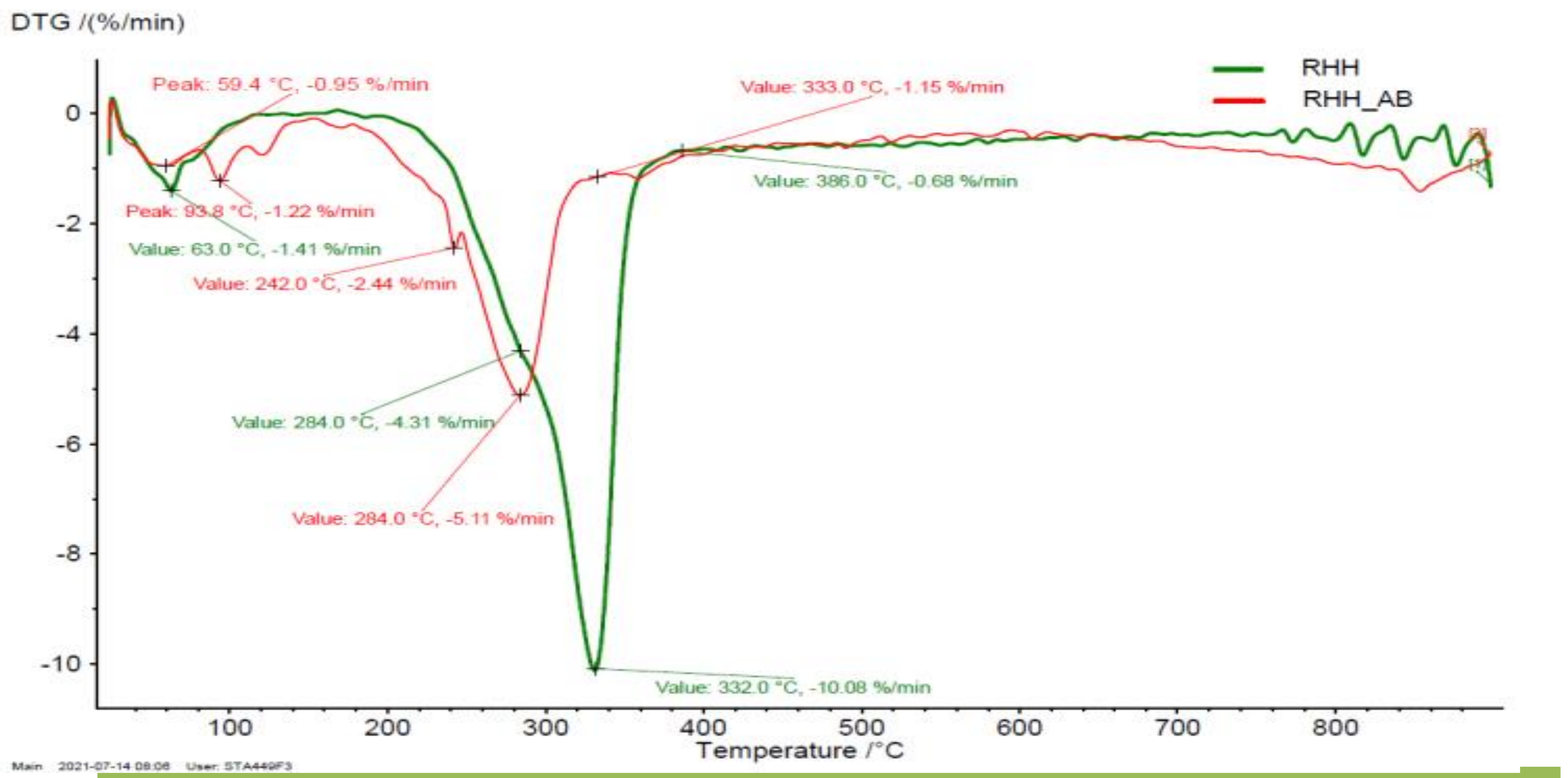

Figure 2A. DTG curve of raw hemp hurds (RHH) and sample excluded from long-term hardened composites (RHH_AB).

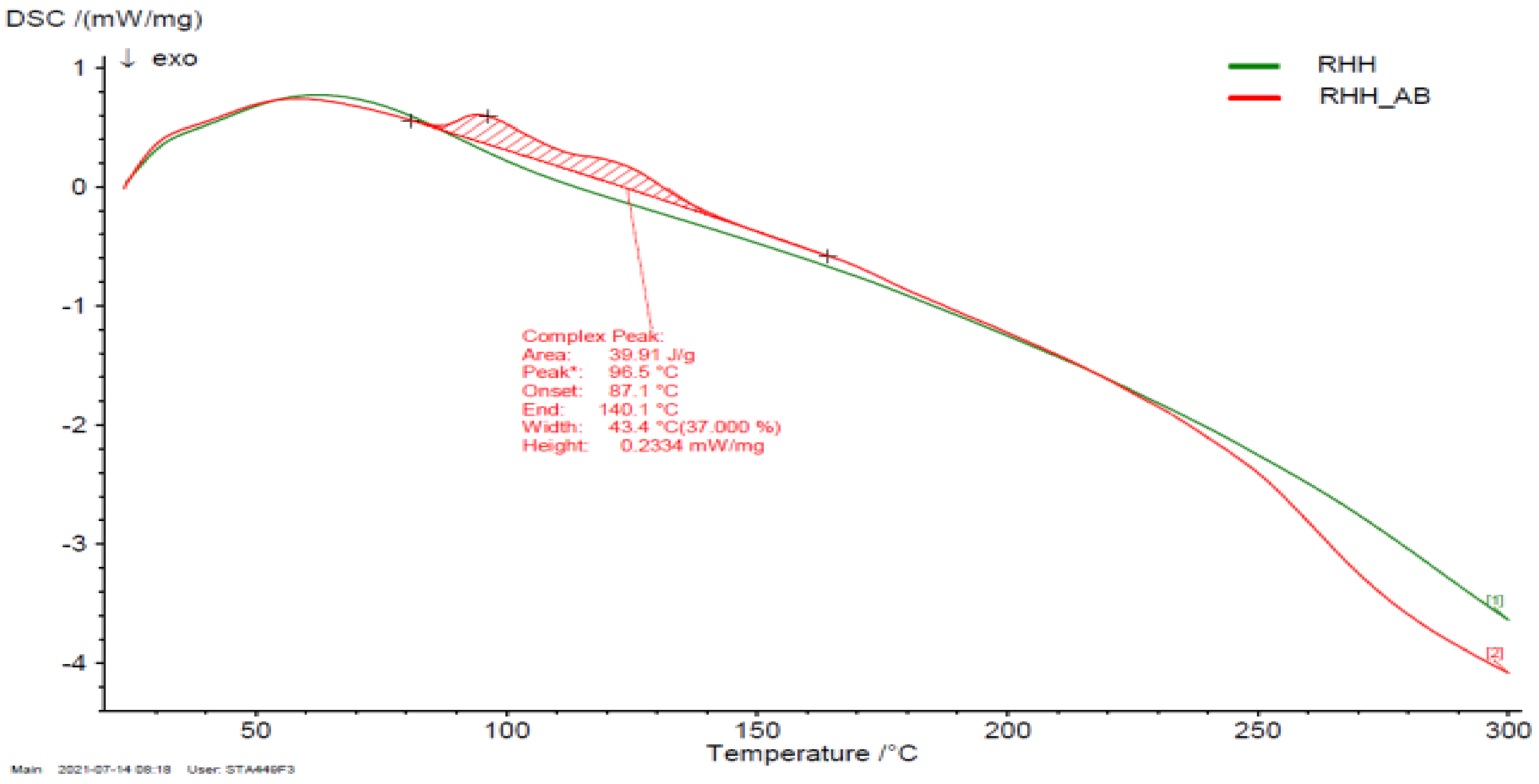

Figure 2B. DSC detail of raw hemp hurds (RHH) and sample excluded from long-term hardened composites (RHH_AB).

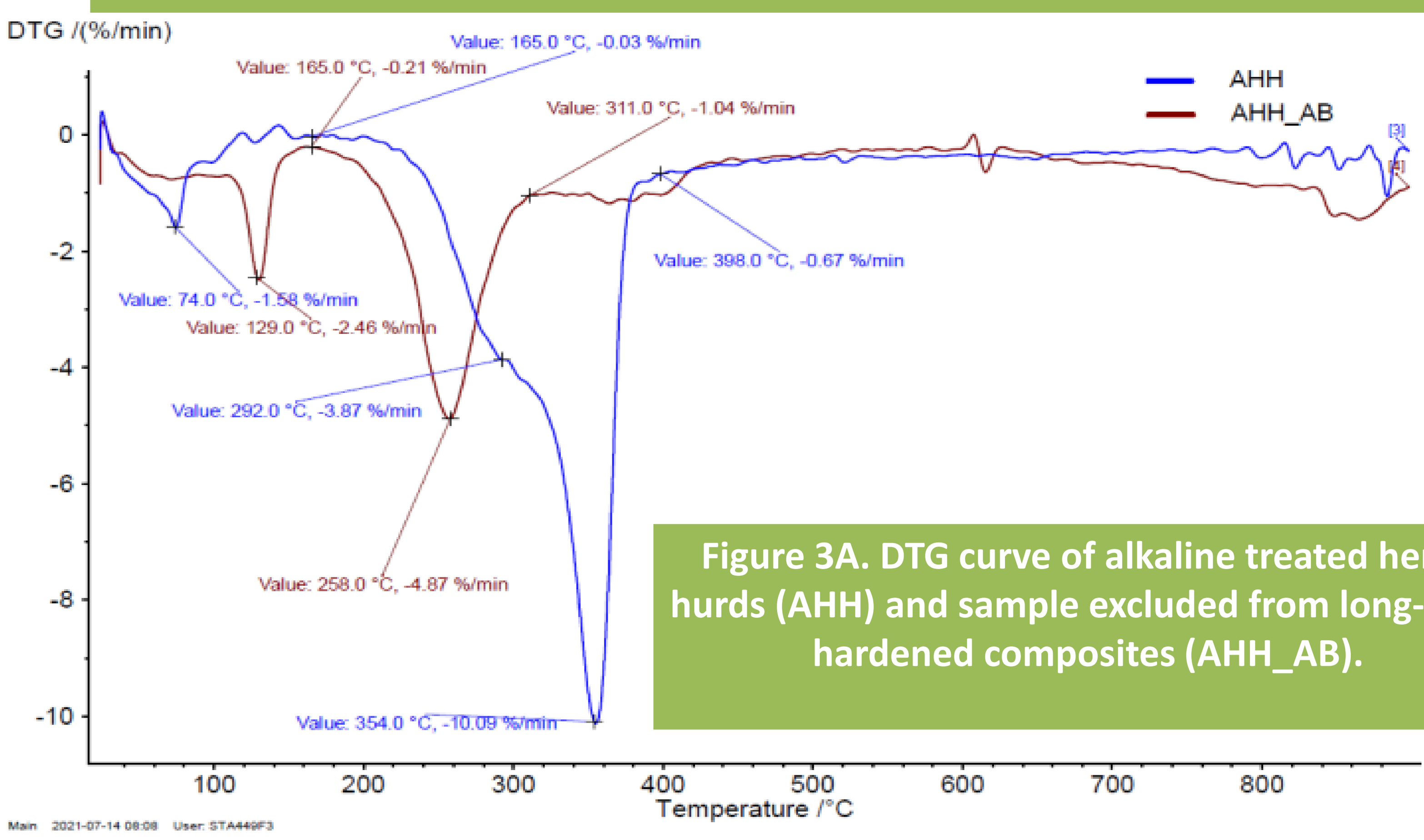

Figure 3A. DTG curve of alkaline treated hemp hurds (AHH) and sample excluded from long-term hardened composites (AHH_AB).

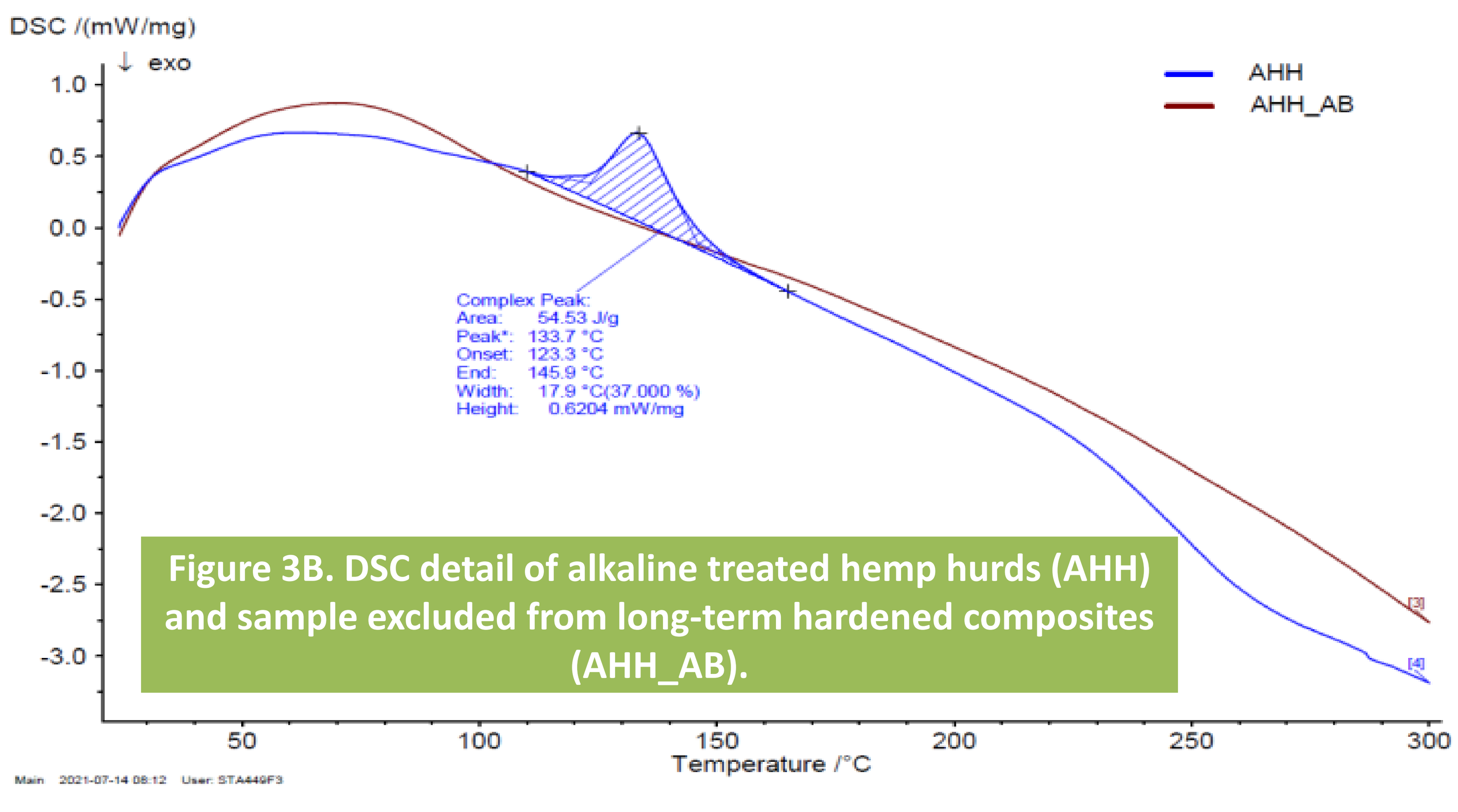

Figure 3B. DSC detail of alkaline treated hemp hurds (AHH) and sample excluded from long-term hardened composites (AHH_AB).

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