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The effect of fiber addition on wheat bread staling

Ewa Ostrowska-Ligęza, Monika Miernicka, Agata Górska, Joanna Bryś and Magdalena Wirkowska-Wojdyła

Warsaw University of Life Sciences (WULS – SGGW), Institute of Food Sciences, Department of Chemistry, Nowoursynowska str. 166, 02-787 Warsaw, Poland

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Introduction

The bread is the staple grain product that many consumers eat every day. The quality and durability of the bread depends, among others, on the recipe, the method of baking, the method of cooling the bread after baking, and the way of packaging. Producers use a lot of techniques to extend the freshness of baking and delay the staling process. In order to extend the freshness of the bread, the producers add enzyme preparations, lipid compounds, emulsifiers or hydrocolloids to the recipe composition.

The purpose of the work was to determine the effect of three types of fiber (wheat, oat, potato) with two fiber lengths on bread staling process. Type 750 bread wheat flour and fiber addition with a specific length of fiber in the amount of 2%, 4% and 6% were used to bake bread.

Materials and Methods

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Studies on the physical and chemical properties of flour were carried out. The bread volume, porosity and texture, crumb moisture and bread staling using differential scanning calorimetry on the day of baking, after 24h, 72h, were determined.

Bread analysis was performed using a differential scanning calorimeter - DSC, Q200, TA Instruments. All measurements were made under a nitrogen atmosphere. The reference sample was an empty aluminium pan, hermetically sealed. The bread mass was 10-15 mg. The DSC curve of bread was obtained by heating the sample from -50 °C to 110 °C at heating rate of 5K / min. Samples were analysed in triplicate.

Materials and Methods

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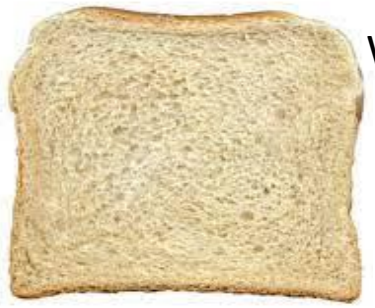
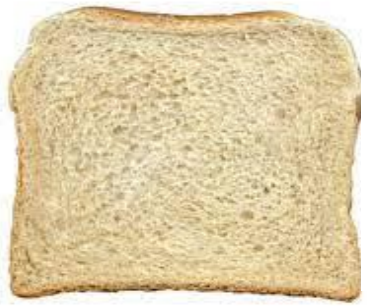


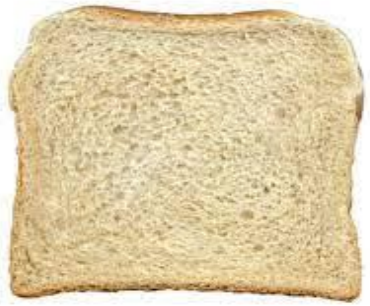
Wheat fiber

fresh, 24 h and 72 h after baking



Potato fiber

fresh, 24 h and 72 h after baking

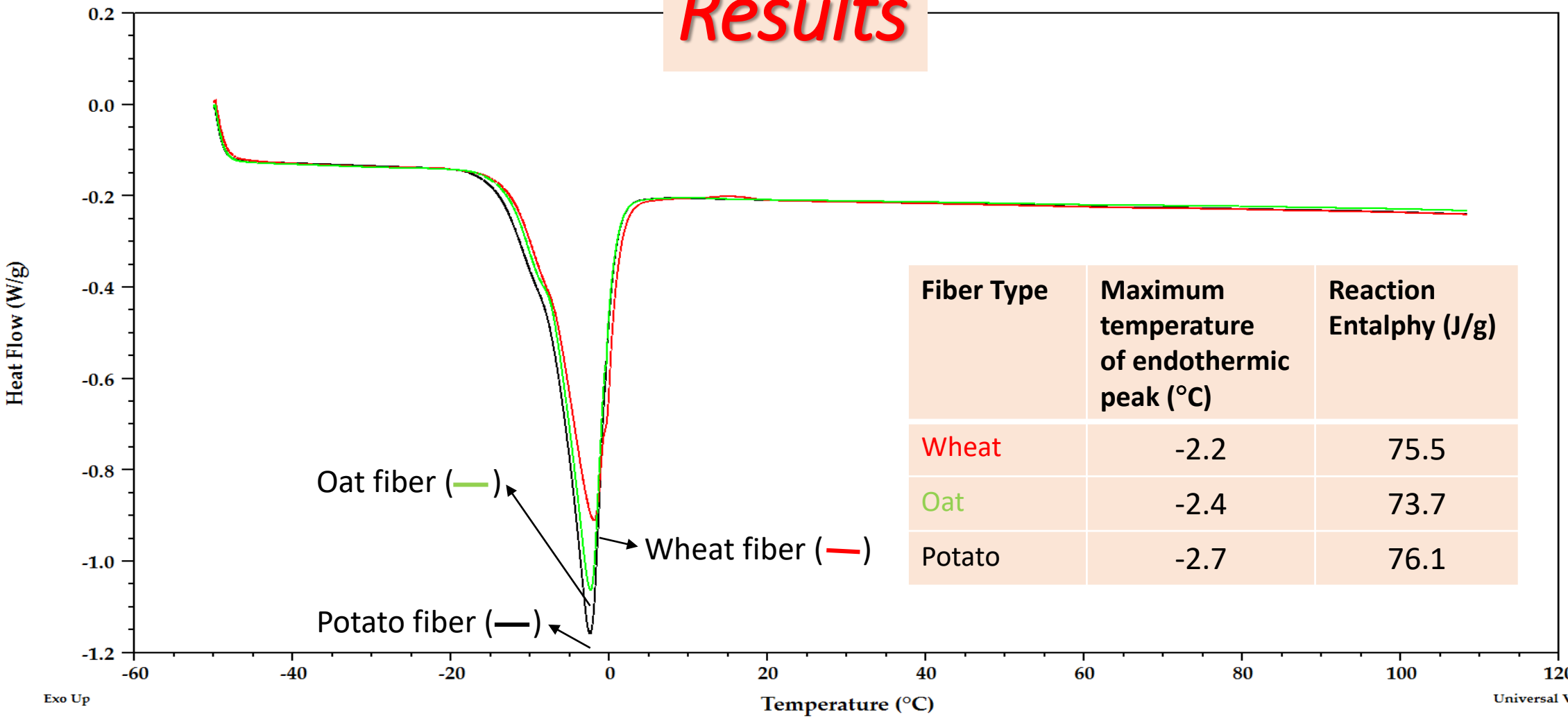


Oat fiber

fresh, 24 h and 72 h after baking

DSC measurements

Results



Fiber Type	Maximum temperature of endothermic peak (°C)	Reaction Entalphy (J/g)
Wheat	-2.2	75.5
Oat	-2.4	73.7
Potato	-2.7	76.1

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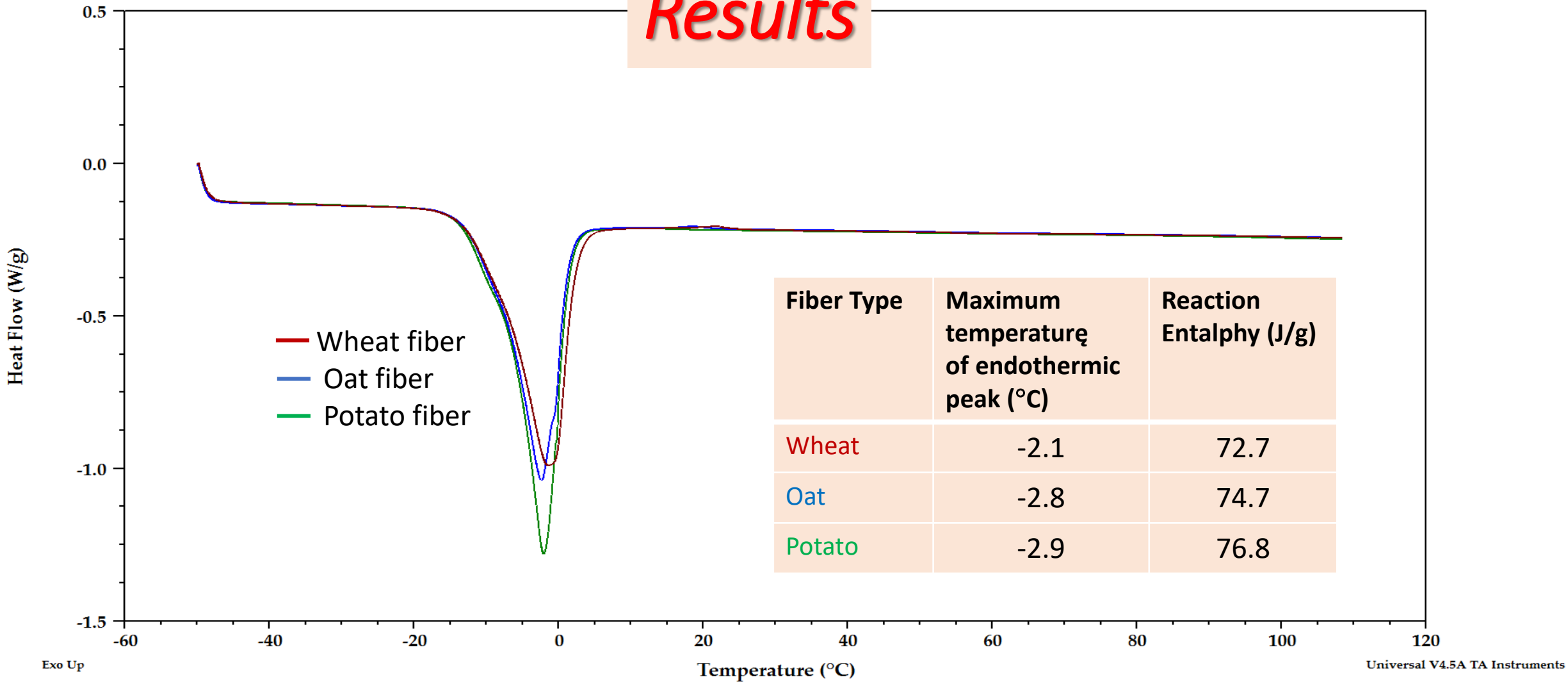
Figure 1. DSC curves of fresh bread with three fiber types: wheat, oat and potato with longer fiber length (amount 6%).

Results



Fiber Type	Maximum temperaturę of endothermic peak (°C)	Reaction Entalphy (J/g)
Wheat	-2.1	72.7
Oat	-2.8	74.7
Potato	-2.9	76.8

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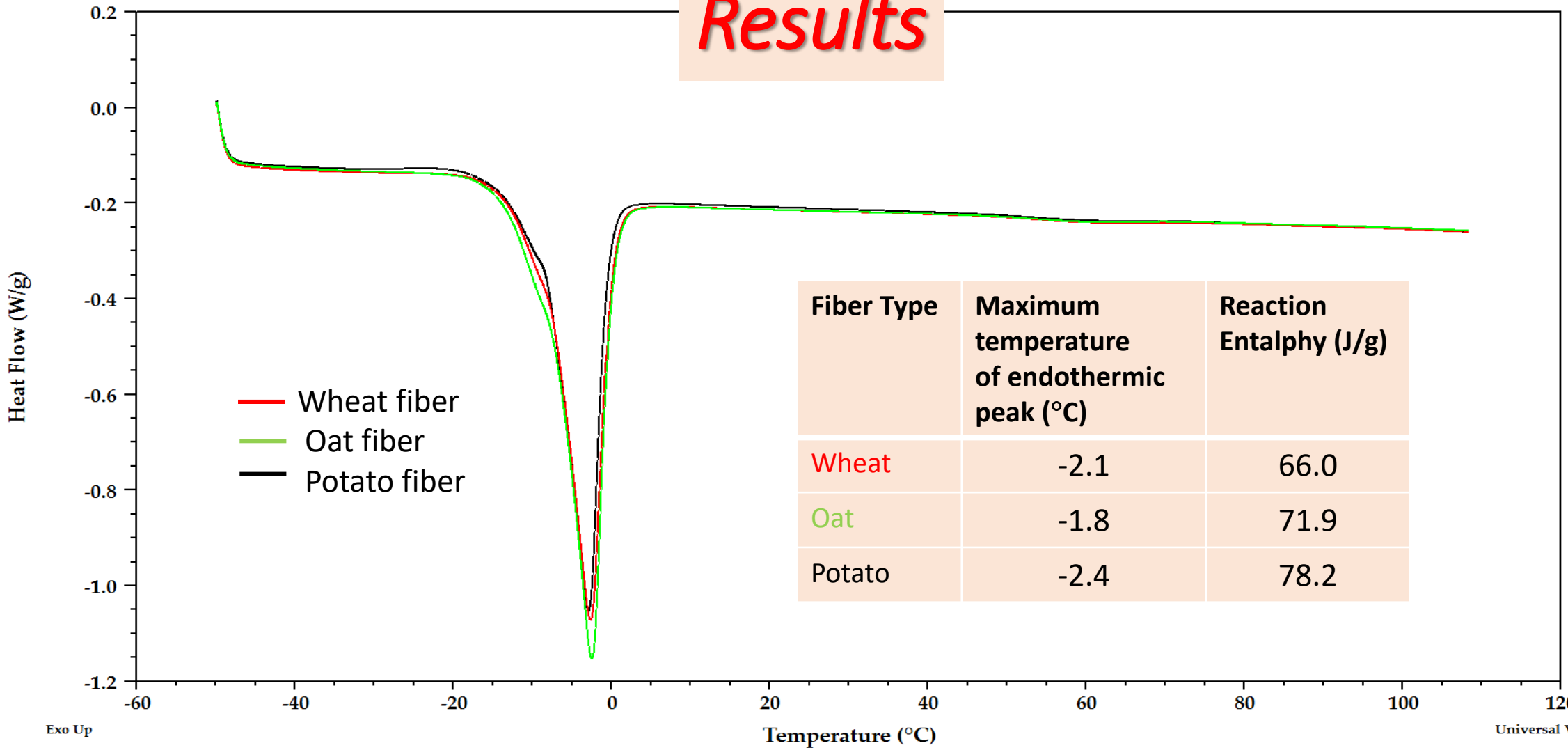
Figure 2. DSC curves of fresh bread with three fiber types: wheat, oat and potato with shorter fiber length (amount 6%).

Results



Fiber Type	Maximum temperature of endothermic peak (°C)	Reaction Entalphy (J/g)
Wheat	-2.1	66.0
Oat	-1.8	71.9
Potato	-2.4	78.2

Figure 3. DSC curves of bread after 24h with three fiber types: wheat, oat and potato with longer fiber length (amount 6%).

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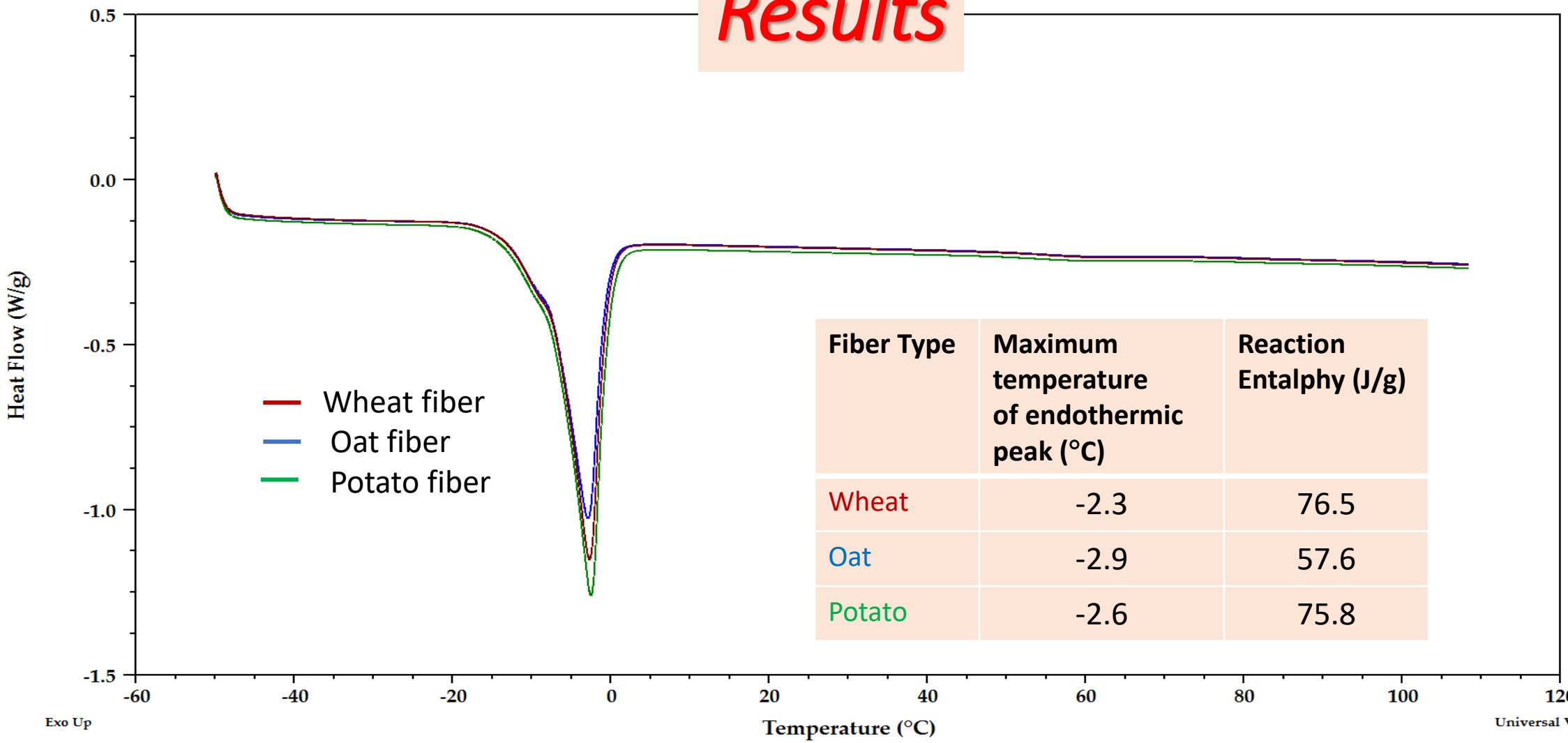
Results



Fiber Type	Maximum temperature of endothermic peak (°C)	Reaction Entalphy (J/g)
Wheat	-2.3	76.5
Oat	-2.9	57.6
Potato	-2.6	75.8

Figure 4. DSC curves of bread after 24h with three fiber types: wheat, oat and potato with shorter fiber length (amount 6%).

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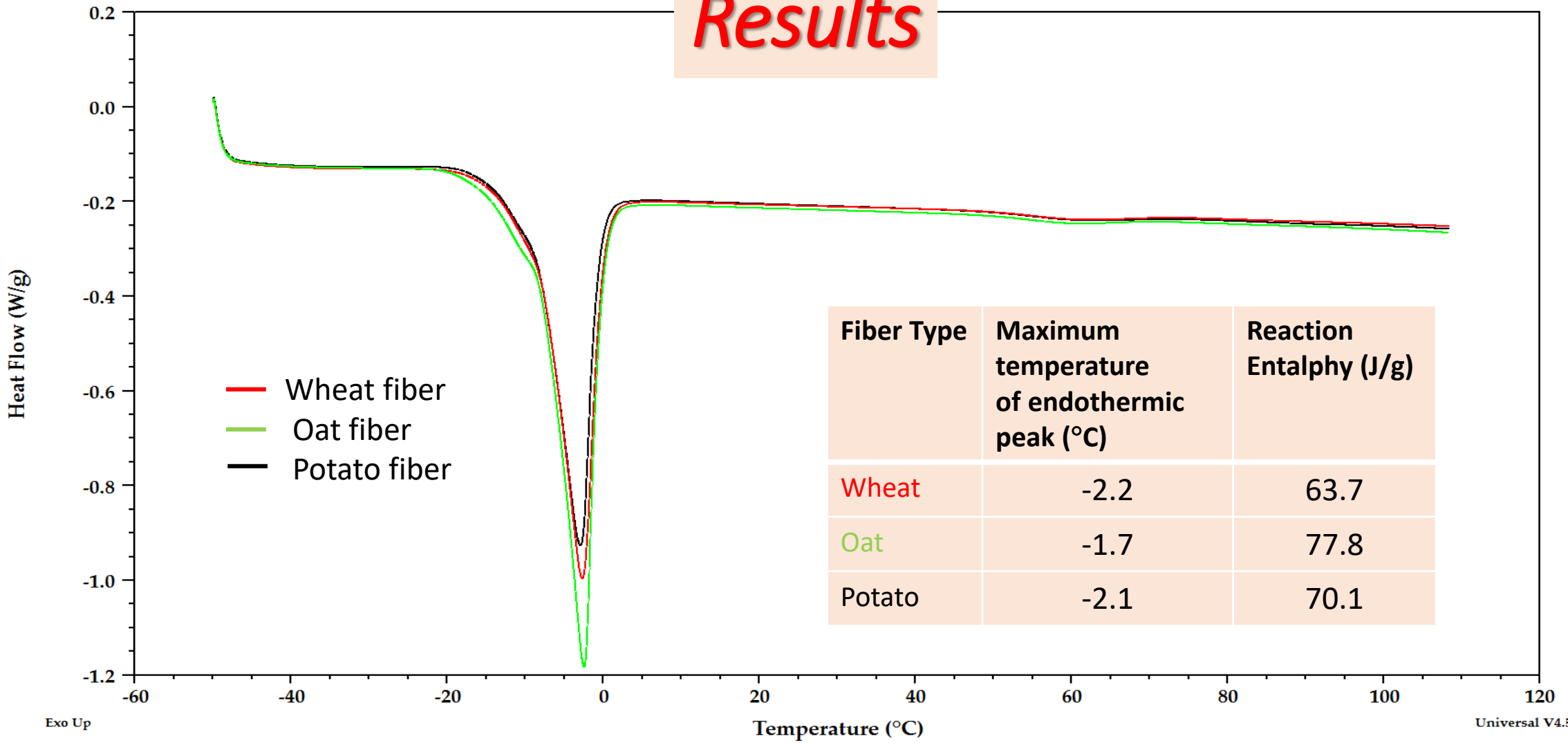
Results



Fiber Type	Maximum temperature of endothermic peak (°C)	Reaction Entalphy (J/g)
Wheat	-2.2	63.7
Oat	-1.7	77.8
Potato	-2.1	70.1

Figure 5. DSC curves of bread after 72h with three fiber types: wheat, oat and potato with longer fiber length (amount 6%).

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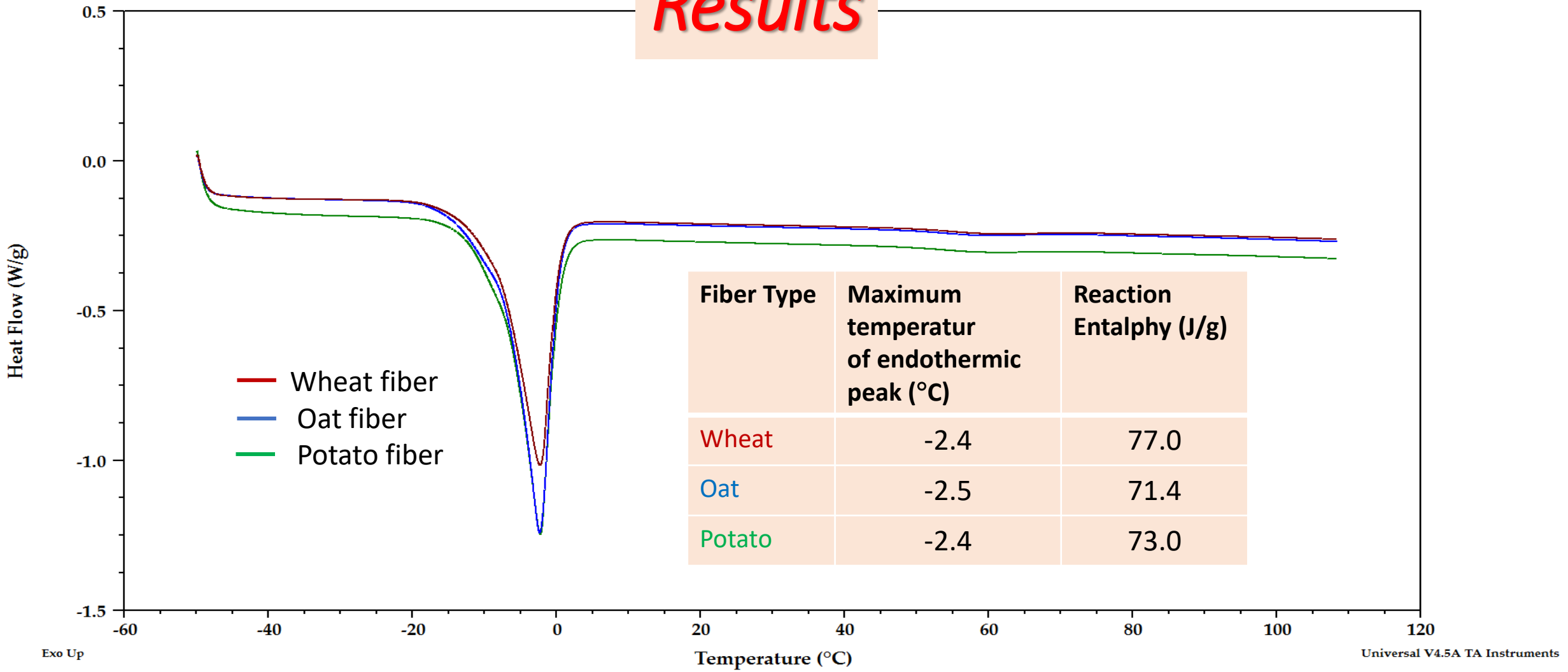
Results



Fiber Type	Maximum temperatur of endothermic peak (°C)	Reaction Entalphy (J/g)
Wheat	-2.4	77.0
Oat	-2.5	71.4
Potato	-2.4	73.0

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Figure 6. DSC curves of bread after 72h with three fiber types: wheat, oat and potato with shorter fiber length (amount 6%).

Results

Only samples with 6% added fiber are presented. The highest enthalpy was determined in the case of bread with 6% addition of wheat fiber with shorter length fiber and bread with 6% addition of longer length potato fiber. The maximum temperature of the endothermic peak of the control was -3°C. The DSC curve of crumb with the addition of 6% shorter length potato fiber was characterized by the lowest temperature of endothermic peak, indicating slower loss of water. On the basis of the research, it was found that in bread enriched with 21g of potato fiber with shorter length fiber, the process of staling was slower than in the control sample.

Conclusions

The influence of the type and amount of fiber as well as fiber length on the staling process was shown. Increased share of wheat and potato fibers with shorter fibers (4% and 6%) accelerated the staling of bread in comparison with the control sample. Bread became stale the fastest, with a 6% share of potato fiber with a longer length fiber, which obtained twice the value of the discussed parameter compared to the sample control. The addition of 2 and 4% oat fiber with shorter fiber length delayed the staling process.