processes

Supplementary Materials

Parameters Optimization and Deformation Energy Modelling of Bulk Hemp Seeds Processing under Uniaxial Compression Loading

Abraham Kabutey *, Mahmud Musayev, Sonia Habtamu Kibret and Su Su Soe

Department of Mechanical Engineering, Faculty of Engineering, Czech University of Life Sciences Prague, 165 20 Prague, Czech Republic; xmusm025@studenti.czu.cz (M.M.); xkibs001@studenti.czu.cz (S.H.K.); xsoes001@studenti.czu.cz (S.S.S.)

* Correspondence: kabutey@tf.czu.cz; Tel.: +420-22438-3180

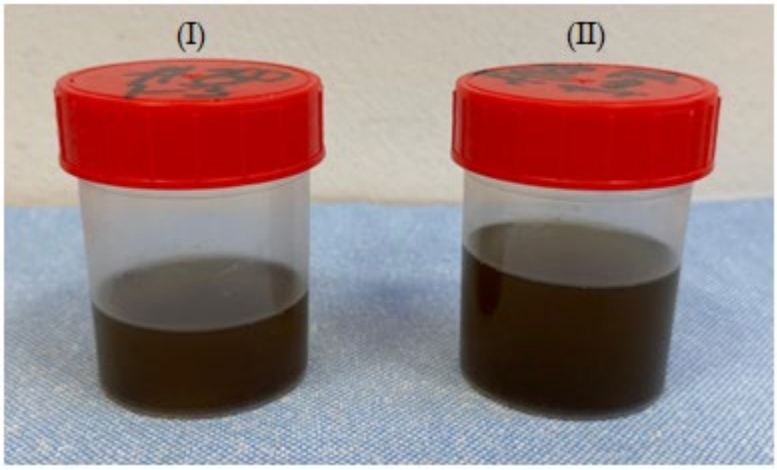


Figure S1. Extracted oils at optimal input processing factors: (I): H_{TP}: Heating temperature (+1: 60 °C); H_{TM}: Heating time (0.5: 52.5 min) and P_{HT}: Initial pressing height of sample (-1: 60 mm) and (II): H_{TP}: Heating temperature (+1: 60 °C); H_{TM}: Heating time (+1: 60 min) and P_{HT}: Initial pressing height of sample (+1: 100 mm).

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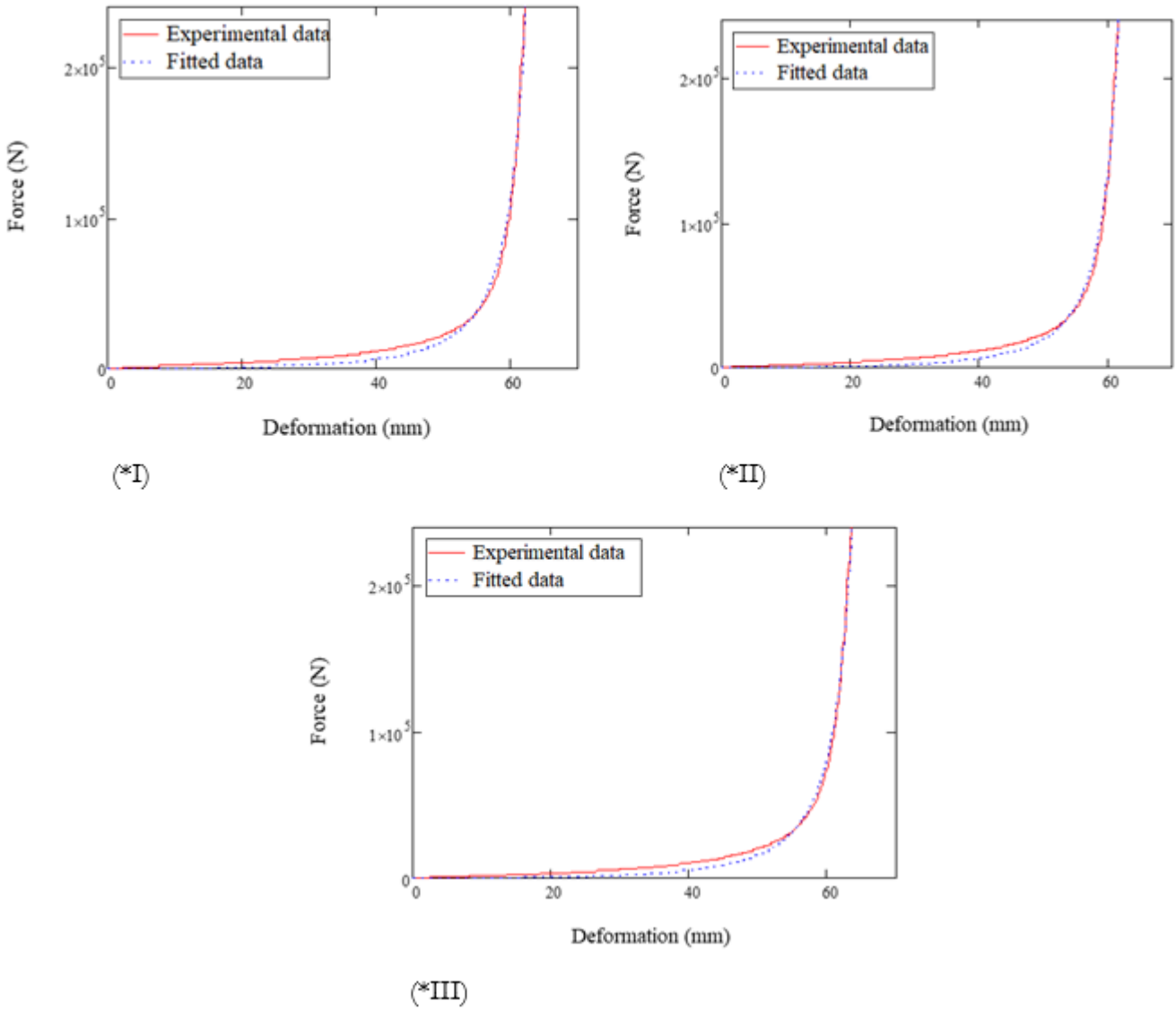


Figure S2. Experimental and fitted data of the force-deformation curves of bulk hempseeds for triplicated tests (I), (II) and (III) at optimal input processing factors for (*): H_{TP}: Heating temperature (+1: 60 °C); H_{TM}: Heating time (0.5: 52.5 min) and P_{HT}: Initial pressing height of sample (–1: 60 mm).

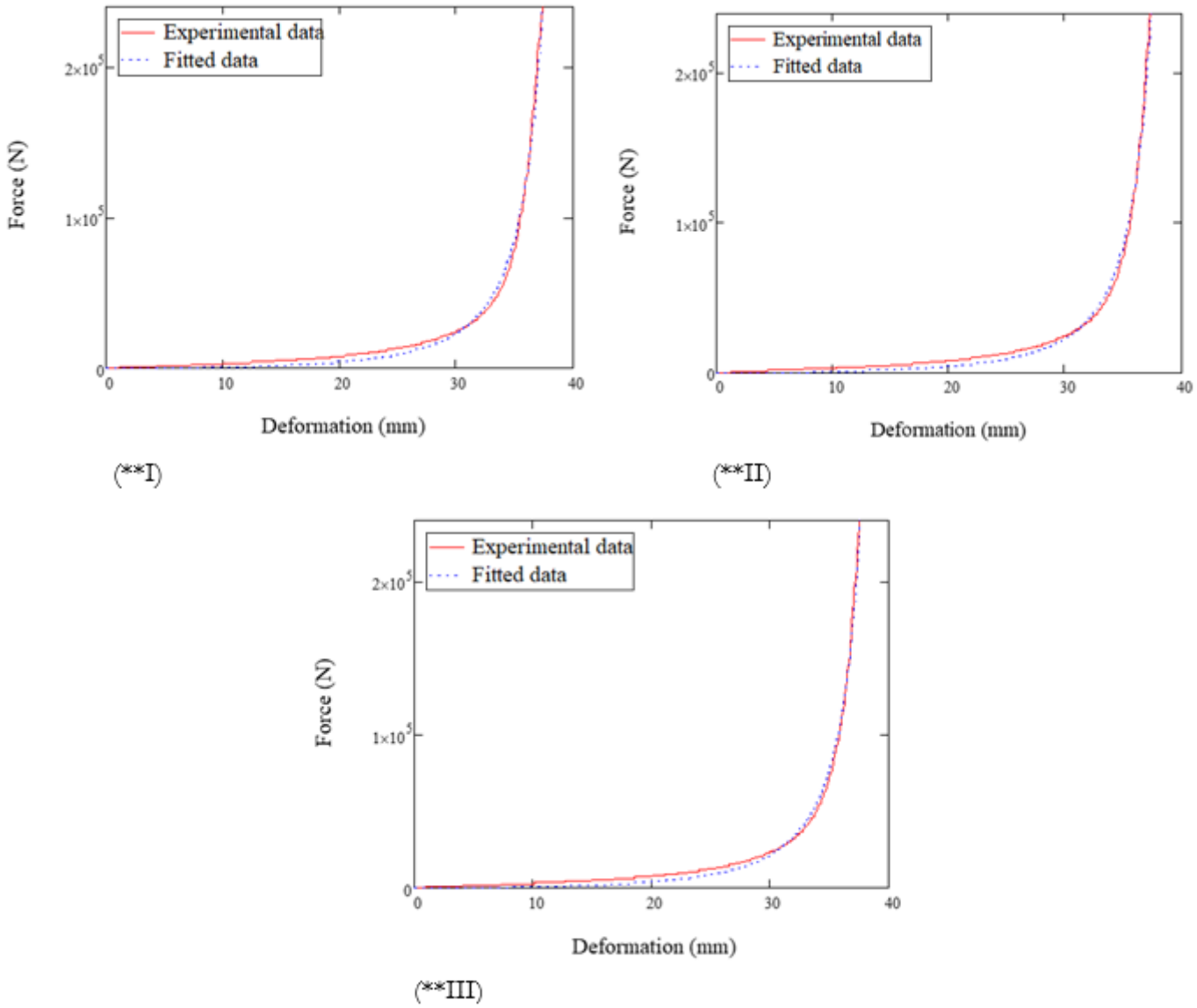


Figure S3. Experimental and fitted data of the force-deformation curves of bulk hempseeds for triplicated tests (I), (II) and (III) at optimal input processing factors for (**): H_{TP}: Heating temperature (+1: 60 °C); H_{TM}: Heating time (+1: 60 min) and P_{HT}: Initial pressing height of sample (+1: 100 mm).

Table S1. Determined coefficients of the tangent curve model and statistical metrics to describe the force-deformation curves of bulk hempseeds at optimal input processing factors.

Tests	X (mm)	A_D (kN)	B_D (mm $^{-1}$)	n (-)	F-value	F-critical	P-value	R^2
*I	37.75	4.743	0.038	2	0.387	3.851	0.534	0.996
*II	37.76	4.579	0.038	2	0.362	3.851	0.548	0.996
*III	37.95	4.502	0.038	2	0.391	3.851	0.532	0.996
Mean	37.820	4.608	0.038	2.000	0.380	3.851	0.538	0.996
SD	0.113	0.123	0.000	0.000	0.016	0.000	0.009	0.000
% CV	0.298	2.671	0.000	0.000	4.136	0.000	1.620	0.000
Tests	X (mm)	A_D (kN)	B_D (mm $^{-1}$)	n (-)	F-value	F-critical	P-value	R^2
**I	63.72	3.332	0.023	2	0.992	3.851	0.319	0.995
**II	62.70	3.288	0.023	2	0.919	3.851	0.338	0.995
**III	62.02	3.358	0.024	2	0.928	3.851	0.336	0.995
Mean	62.813	3.326	0.023	2.000	0.946	3.851	0.331	0.995
SD	0.856	0.035	0.001	0.000	0.040	0.000	0.010	0.000
% CV	1.362	1.064	2.474	0.000	4.206	0.000	3.154	0.000

Validation tests triplicated at optimal input processing factors for (*): H_{TP}: Heating temperature (+1: 60 °C); H_{TM}: Heating time (0.5: 52.5 min) and P_{HT}: Initial pressing height of sample (–1: 60 mm), (**): H_{TP}: Heating temperature (+1: 60 °C); H_{TM}: Heating time (+1: 60 min) and P_{HT}: Initial pressing height of sample (+1: 100 mm); X is the experimental deformation, D_{FX} (mm), A_D is the force coefficient of mechanical behaviour (kN), B_D is the deformation coefficient of mechanical behaviour (mm^{-1}), n is the model's fitting exponent (-), F-value < F-critical or P-value > 0.05 means significant, and R^2 is the coefficient of determination of the tangent model.

Table S2. Determined amounts of experimental and theoretical energies of bulk hempseeds at optimal input processing factors: * (H_{TP}: (+1: 60 °C); H_{TM}: (0.5: 52.5 min) and P_{HT}: (–1: 60 mm)).

Test	Optimal input processing factors			Experimental and theoretical deformation energy		
	H_{TP} (° C)	H_{TM} (min)	P_{HT} (mm)	E_{NG} (J)	TE_{NG} (J)	Error (%)
*I	60	52.5	60	869.75	731.042	18.974
*II	60	52.5	60	864.03	708.206	22.003
*III	60	52.5	60	854.85	744.629	14.802
			Mean	862.88	727.959	18.593
			SD	7.52	18.406	
			% CV	0.87	2.528	

H_{TP}: Heating temperature; H_{TM}: Heating time; P_{HT}: Initial pressing height of sample; E_{NG}: Experimental deformation energy; TE_{NG}: Theoretical deformation energy; SD: Standard Deviation, and CV: Coefficient of Variation.

Table S3. Determined amounts of experimental and theoretical energies of bulk hempseeds at optimal input processing factors: ** (H_{TP}: (+1: 60 °C); H_{TM}: (+1: 60 min) and P_{HT}: (+1: 100 mm)).

Test	Optimal input processing factors			Experimental and theoretical deformation energy		
	H_{TP} (° C)	H_{TM} (min)	P_{HT} (mm)	E_{NG} (J)	TE_{NG} (J)	Error (%)
**I	60	60	100	1223.26	1159.21	5.525
**II	60	60	100	1267.03	898.51	41.015
**III	60	60	100	1250.81	1487.64	15.920
			Mean	1247.033	1181.787	20.820
			SD	22.128	295.213	
			% CV	1.774	24.980	

H_{TP}: Heating temperature; H_{TM}: Heating time; P_{HT}: Initial pressing height of sample; E_{NG}: Experimental deformation energy; TE_{NG}: Theoretical deformation energy; SD: Standard Deviation, and CV: Coefficient of Variation.

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