Correction to: Influence of pressure and CO₂ in fluidized bed gasification of waste biomasses

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The original version of this article unfortunately contained mistakes. The presentation of Eqs. 1–5 and in-line equations in Table 3 were incorrect in the PDF version. Also, unnecessary dash were inserted in the 4th row of Table 4. The corrected equations and tables are given below.

$$\frac{H_2O}{C} = \frac{\dot{m}_{Steam,ga} + \dot{m}_{H_2O,fuel}}{\dot{m}_{C,fuel}} \quad (1)$$

$$CGE = \frac{(HHV_{pg}) \times \dot{m}_{pg} \times 100\%}{(HHV_{fuel}) \times \dot{m}_{fuel}} \quad (2)$$

$$\varphi_{C,fuel \rightarrow C,pg} = \frac{X_{C,pg} \times \dot{m}_{pg} \times 100\%}{X_{C,fuel} \times \dot{m}_{fuel}} \quad (3)$$

$$\varphi_{C,in \rightarrow C,pg} = \frac{X_{C,pg} \times \dot{m}_{pg} \times 100\%}{X_{C,fuel} \times \dot{m}_{fuel} + \dot{m}_{C,CO_2,ga}} \quad (4)$$

$$\frac{H_2O}{(C + CO_2)} = \frac{\dot{m}_{Steam,ga} + \dot{m}_{H_2O,fuel}}{\dot{m}_{C,fuel} + \dot{m}_{CO_2,ga}} \quad (5)$$

Table 3 Collation of the most important gasification reactions impacted by the partial pressure of H₂O and CO₂

Irreversible reactions	
$C + O_2 \rightarrow CO_2$ Complete oxidation of C	$Q = -405 \frac{kJ}{mol}$
$H_2 + \frac{1}{2} O_2 \rightarrow H_2O$ Oxidation of H ₂	$Q = -242 \frac{kJ}{mol}$
Reversible reactions	
$C + H_2O \rightleftharpoons CO + H_2$ Water–gas reaction	$Q = 131 \frac{kJ}{mol}$
$CO + H_2O \rightleftharpoons CO_2 + H_2$ Water–gas shift reaction	$Q = -41 \frac{kJ}{mol}$
$C_xH_y + xH_2O \rightleftharpoons xCO + \frac{(y+2x)}{2} H_2$ The general steam re forming reaction	$Q = +(endo.)$
$C + CO_2 \rightleftharpoons 2CO$ Boudouard's reaction	$Q = 172 \frac{kJ}{mol}$
$C_xH_y + xCO_2 \rightleftharpoons xCO + \frac{y}{2} H_2$ or $C_xH_y + \frac{y}{4} CO_2 \rightleftharpoons \left(x + \frac{y}{4}\right) C + \frac{y}{2} H_2O$ The general CO ₂ re forming reaction	$Q = +(endo.)$

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Table 4 Results of experimental test runs, process efficiency parameters and indices

Fuel	Softwood pellet			Oak bark			Lignin		
Run number	1	2	3	4	5	6	7	8	9
In bed temp. (°C)	852.8	843.6	853.6	853.3	853.7	854.9	852.0	853.9	–
Reactor pressure (bar _g)	0.0	1.0	1.9	0.0	1.0	2.0	0.0	1.0	2.0
Fuel ar. (kg/h; kW)	2.52; 13.9	5.64; 30.9	7.35; 39.9	2.95; 14.0	5.73; 27.6	8.51; 41.0	2.62; 14.6	5.37; 29.6	–
Composition of the gasifying agent (kg/h)									
O ₂	1.02	1.81	2.77	1.08	2.14	3.04	1.28	2.58	–
CO ₂	2.90	2.74	6.62	3.18	4.95	4.95	4.36	5.33	–
H ₂ O	0.73	2.48	3.70	0.60	2.49	3.86	0.70	2.70	–
Product gas composition (vol% dry)									
H ₂	11.88	15.16	13.21	14.21	15.60	19.66	12.13	18.00	–
CO	21.62	24.00	23.56	24.18	27.01	25.10	24.91	26.04	–
CO ₂	53.41	42.44	48.84	49.71	44.39	43.12	52.00	44.45	–
CH ₄	4.67	8.76	8.70	4.21	4.77	6.05	3.18	4.21	–
C ₂ H ₄	2.46	3.32	2.60	1.59	1.41	1.52	1.01	1.00	–
C ₂ H ₆	0.26	0.37	0.27	0.14	0.16	0.31	0.18	0.09	–
HHV (MJ/Nm ³)*	8.42	11.41	10.27	8.15	8.78	9.72	7.08	8.38	–
Product gas yield (Nm ³ /kg _{dar})	1.61	1.31	1.57	1.74	1.63	1.55	2.26	1.94	–
H ₂ O (g/Nm ³)	228.1	364.0	383.0	161.0	306.0	309.0	172.8	312.0	–
Tar (g/Nm ³)**	5.50	5.29	4.34	0.64	5.20	5.60	1.62	4.95	–
Solids (g/Nm ³)	4.54	3.30	2.60	68.76	54.77	52.52	10.51	7.87	–
FB gasification parameters									
U/U _{mfr} (–)	8.93	7.99	7.31	8.87	9.84	8.79	11.57	11.39	–
λ (–)	0.30	0.24	0.30	0.29	0.29	0.28	0.34	0.33	–
H ₂ O/C (g/g)	0.67	1.00	1.15	0.55	0.99	1.03	0.73	1.21	–
H ₂ O/(C+CO ₂) (mol/mol)	0.27	0.53	0.51	0.22	0.44	0.51	0.26	0.57	–
H ₂ /CO (vol%/vol%)	0.55	0.63	0.56	0.59	0.58	0.78	0.49	0.69	–
Gasification efficiency parameters (%)									
CGE – Eq. 2	70.9	77.4	73.1	76.8	78.3	79.2	76.2	75.1	–
CCE – Eq. 3	160.5	125.2	148.6	158.4	145.5	129.5	185.8	150.9	–
CCE – Eq. 4	98.4	98.7	99.0	97.2	97.3	97.1	98.7	98.6	–

* Product gas in the dry state with CO₂

** Tar measurement and definition described above

The original article has been corrected.

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