

1. 基本情報

区分	森林	担当者名	芳賀弘和
タイトル (英文)	Burning radionuclide question: What happens to iodine, cesium and chlorine in biomass fires?		
タイトル (和文)	燃焼する放射性物質に関する疑問：燃焼バイオマス中のヨウ素、セシウム、塩素に何が起きるのか？		
キーワード			
著者	Amiro et al.		
文献	The science of the Total Environment, 187: 93-103 (1996)		

(1) 対象地域

Field と Lab とあるが、具体的には記載なし

(2) 重要な図表

Table 1
Characteristics of field burns

	Burn number				
	1	2	3	4	5
Fuel type	straw	straw	straw	pine	aspen
Fuel loading (kg)	50	50	25	100	150
Fuel load sampled (kg)	4	4	2	100	150
Highest temp (°C)	840	700	620	1100	1080
°C-h mean	80	30	20	1025	3430
°C-h range	2-119	0-112	11-33	283-1929	765-6940
Minutes above 50°C (mean)	17	8	7	166	276
Mass of unburnt straw (kg)		2.6			
Ash/fuel ratio (g ash kg ⁻¹ wet)	120	170	90	6b ^a ;3g ^a	4b;19g
CO in air (% mol)	6.7	1.7	1.4	1.6	2.1
CO ₂ in air (% mol)	0.08	0.5	0.4	0.6	0.5
Ratio CO/CO ₂	84	3.6	3.5	2.5	4.4
Initial concentration I (g · kg ⁻¹) calculated	2.0	2.0	2.0	0.5	0.7
Initial concentration I (g · kg ⁻¹) measured		1.7 ± 0.01	2.0 ± 0.05	1.7 ± 0.04	4.0 ± 0.06
Post-burn mean concentration I (g · kg ⁻¹)	7.1	3.6	5.3	0.9b;3.6g	1.2b;1.4g
Post-burn S.D. concentration I (g · kg ⁻¹)	0.6	2.0	1.4	0.03b;0.04g	0.04b;0.02g
Number of post-burn samples I	15	16	8	3b; 2g	3b; 3g
Original mass of I in pans (g) calculated	8	5.2	4	50	100
Mass of I in ash (g)	3.2	0.95	0.9	1.8	4.7
% I recovery in ash	40	18	22	4	5
Ash enrichment I (g wet biomass g ⁻¹ ash)	3.5	1.8	2.6	1.8b; 7.1g	1.8b; 2.1g
Gaseous I in air (mg · m ⁻³)	6.0	2.1	2.1	0.2	1.5
Particle I in air (mg · m ⁻³)	2.9	0.2	0.3	0.1	0.3
Ratio I gas/particle	2	11	7	2	5
Initial concentration Cs (g · kg ⁻¹) calculated	2.0	2.0	2.0	0.5	0.7

Table 1 (Continued)

	Burn number				
	1	2	3	4	5
Initial concentration Cs (g·kg ⁻¹) measured		3.4 ± 0.04	2.1 ± 0.1	2.2 ± 0.08	4.6 ± 0.01
Post-burn concentration Cs (g·kg ⁻¹)	16.2	8.2	15.8	5.9b; 4.7g	15.4b; 16.4g
Post-burn S.D. concentration Cs (g·kg ⁻¹)	1.1	3.6	6.4	0.2b; 0.04g	0.8b; 0.4g
Number of post-burn samples Cs	15	16	8	3b; 2g	3b; 3g
Original mass of Cs (g) calculated	8	5.2	4	50	100
Mass of Cs in ash (g)	7.4	2.1	2.6	5.4	56.1
% Cs recovery in ash	93	40	65	11	56
Ash enrichment Cs (g wet-biomass g ⁻¹ ash)	8.1	4.1	7.9	11.8b; 9.4g	23b; 25g
Particle Cs in air (mg·m ⁻³)	1.7	0.1	0.4	0.1	0.2
Initial concentration Cl (g·kg ⁻¹) measured	1.2 ± 0.007	1.2 ± 0.007	1.2 ± 0.007	<0.02	<0.02
Post-burn concentration Cl (g·kg ⁻¹)	1.0 ± 0.01	0.7 ± 0.03	5.3 ± 0.9	0.05b; <0.3g	0.05b; 0.08g
Number of post-burn samples Cl	8	8	8	2	2
Original mass of Cl (g) measured	5	1.7	2.5		
Mass of Cl in ash (g)	0.45	0.2	0.9	0.03b; <0.09g	0.03b; 0.22g
% Cl recovery in ash	9	11	36		
Ash enrichment Cl (g wet g ⁻¹ ash)	0.8	0.5	4.3		

^ab, black ash; g, grey ash.

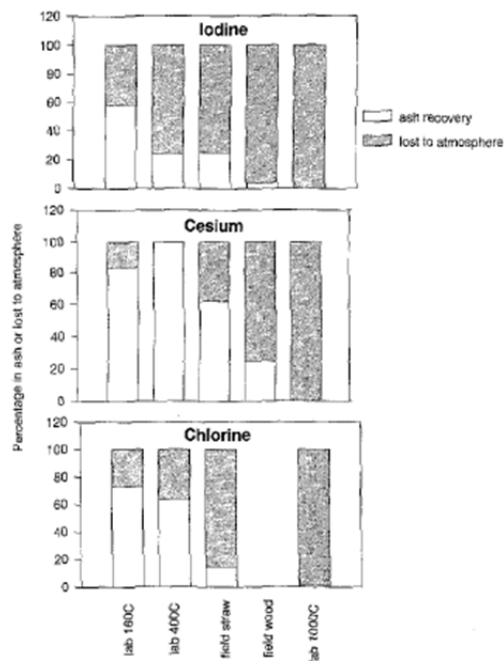


Fig. 4. Percent recovery in ash and loss to the atmosphere of I, Cs and Cl. Data are based on geometric means of all fuel types in the laboratory burns ($n = 5$), and for straw ($n = 3$) and wood ($n = 2$) in the field burns. The ordering from left to right reflects increasing combustion temperature. Data for Cl in the field wood burns are unavailable because initial concentrations were below detection levels.

2. 提言につながる情報

(1) モニタリングへの活用

(2) 流出挙動・経路

Straw, wood, peat, dulse, radish を燃やすと、燃焼温度によって灰に含まれる I, Cs, Cl の量 (recovery) が異なる。燃焼温度が高いほど、大気に放出される量が増えるため、recovery が減る。

(3) 除染の際の留意点

(4) 担当者のコメント

実験室（マッフル炉内）での計測のみならず、straw と wood を実際に field で燃やして、データを得ている点が重要だと感じた。燃焼温度によって、灰への蓄積と大気への放出の割合が異なる点も、森林火災やガレキ焼却などのことを考えると重要と感じた。