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Comments on "Global trends of solid waste research from 1997 to 2011 by using bibliometric analysis"

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Non-alphabetic characters in a search filter should not be overlooked in bibliometric research. Since further results and discussion depend on the data abstracted by the search filter, omission or misuse of non-alphabetic characters in a search filter may lead to inaccurate results and wrong conclusions. The paper titled "Global trends of solid waste research from 1997 to 2011 by using bibliometric analysis" by Yang et al. (2012) may have made such an error, even though the authors stated "Care has been exercised to examine the data collected to assure their identity" (Yang et al. 2012).

In the section of materials and methods, the authors stated that "solid waste*" was used as the string to search topic (including titles, abstracts, and keywords) from 1997 to 2011 (Yang et al. 2012). However, a check on the extraction with the same string Topic = ("solid waste*") generated only 9,348 papers in the same period, a drastic decrease of 61 % compared to 24,026 papers from Yang et al. The result was different with the authors' claim. Using Topic = ("solid waste*"), we also checked another paper by Fu et al. (2010), as these two papers are nearly identical in research content and methods, just different in investigation periods: 1993–2008 (Fu et al. 2010) and 1997–2011 (Yang et al. 2012). Comparing to the total publications of 6,980 from 1993 to 2008 presented by Fu et al. (2010), 7,026 papers were found during 1993–2008 in our result. The comparison of article output of the same years in two different articles during 1997–2008 was

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Table 1 The comparison of article outputs of the same years in two different articles during 1997–2008

Publication year	Data from Yang et al. (2012)	Data from Fu et al. (2010)
1997	706	243
1998	798	277
1999	768	250
2000	854	277
2001	917	300
2002	980	340
2003	1,163	391
2004	1,274	414
2005	1,440	458
2006	1,665	536
2007	1,647	688
2008	2,552	815

Table 2 Characteristics of article outputs during 1997–2011

Years	A	PG	PG/A	NR	NR/A	AU	AU/A	J	A/J
1997	242	2,812	12	5,656	23	702	3	117	2
1998	278	2,765	9.9	6,164	22	880	3	137	2
1999	249	2,604	11	5,528	22	843	3	125	2
2000	279	2,719	9.7	6,212	22	909	3	129	2
2001	300	3,121	10	6,996	23	980	3	138	2
2002	341	3,407	10	8,322	24	1,176	3	150	2
2003	394	4,080	10	9,944	25	1,390	4	185	2
2004	414	4,001	9.7	10,448	25	1,484	4	187	2
2005	462	4,518	9.8	12,554	27	1,671	4	183	3
2006	545	5,305	9.7	15,668	29	1,994	4	190	3
2007	694	6,649	9.6	20,052	29	2,618	4	241	3
2008	836	7,639	9.1	24,320	29	3,157	4	256	3
2009	947	8,251	8.7	29,567	31	3,636	4	283	3
2010	970	8,940	9.2	32,730	34	3,829	4	326	3
2011	962	8,804	9.2	32,876	34	3,865	4	336	3

A number of articles, *PG* page count, *PG/A* the average page count per article, *NR* cited reference count, *NR/A* the average cited reference count per article, *AU* number of authors, *AU/A* the average authors per article, *A/J* the average number of articles published per journal

demonstrated in Table 1. Besides, we conducted a search using Topic = (solid waste*), and 24,080 papers were found in Science Citation Index Expanded between 1997 and 2011, a number almost equal to that by Yang et al. (2012). It could be deduced that in fact Yang et al. (2012) used the search terms (solid waste*) rather than ("solid waste*") as they described in method. Topic = ("solid waste*") finds records containing the exact phrase solid waste*, while Topic = (solid waste*) finds records containing the words

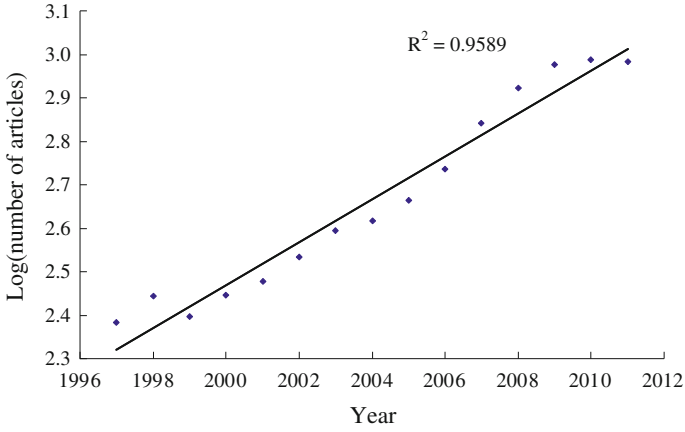

Fig. 1 Log-transformed number of articles on solid waste during 1997–2011

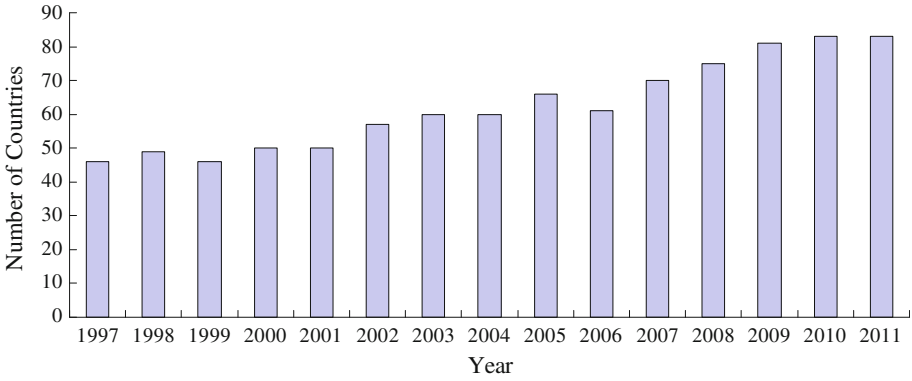

Fig. 2 Growth trends of number of countries/territories in 1997–2011

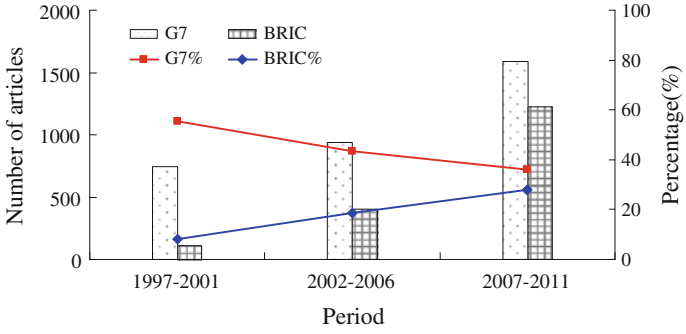

Fig. 3 Comparison between G7 and BRIC countries on the number and percentage of articles

solid and waste*. The two words may or may not appear in the same Topic field. Therefore, the records with solid and waste* in different Topic fields, which may be not related to solid waste*, could also be found in the paper by Yang et al. (2012), such as the

Table 3 Top 20 most productive countries/territories of articles during 1997–2011

Countries/territories	1997–2011 TA	1997–2011 (%)	1997–2001 *R* (%)	2002–2006 *R* (%)	2007–2011 *R* (%)
USA	1,113	14	1 (25)	1 (15)	2 (10)
Mainland China	895	11	12 (2.2)	2 (8.1)	1 (16)
Spain	603	7.7	2 (7.6)	5 (6.8)	3 (8.1)
India	548	7.0	11 (3.9)	3 (7.7)	4 (7.5)
Japan	490	6.2	3 (7.0)	4 (7.5)	7 (5.4)
Canada	474	6.0	4 (6.2)	6 (5.9)	5 (6.1)
Italy	429	5.5	6 (5.3)	9 (4.9)	6 (5.7)
UK	366	4.7	5 (6.1)	7 (5.1)	11 (4.0)
France	337	4.3	8 (4.4)	11 (4.2)	9 (4.3)
Taiwan	330	4.2	7 (5.2)	10 (4.3)	12 (3.9)
Turkey	319	4.1	19 (1.4)	8 (5.0)	8 (4.4)
Brazil	244	3.1	21 (1.2)	16 (2.2)	10 (4.1)
Sweden	222	2.8	10 (4.1)	13 (3.3)	15 (2.2)
Germany	216	2.7	9 (4.4)	12 (3.3)	16 (2.0)
South Korea	201	2.6	14 (1.8)	14 (3.0)	13 (2.5)
Greece	179	2.3	16 (1.7)	17 (2.2)	14 (2.5)
Denmark	143	1.8	23 (1.0)	15 (2.4)	19 (1.8)
Australia	115	1.5	17 (1.6)	20 (1.5)	21 (1.4)
Netherlands	110	1.4	13 (2.0)	18 (2.0)	29 (1.0)
Malaysia	106	1.3	31 (0.6)	28 (0.8)	18 (1.8)

TA total published articles in the 15 years, % percentage of all articles published in the years

paper titled "A waste of time: the problem of common morality in *Principles of Biomedical Ethics*" with solid in its abstract and waste in its title (Karlsen and Solbakk 2011). In terms of the analysis concerning author keywords, wastewater ranked top 4 by Yang et al. (2012) but fell out of top 20 by Fu et al. (2010). This might be attributed to that waste* would be more likely to be appeared as wastewater among the abstracted publications, with Topic = (solid waste*). For example, the paper titled "Synthesis by precipitation polymerization of molecularly imprinted polymer for the selective extraction of diclofenac from water samples" with solid in the phrase solid-phase extraction and wastewater in its abstract (Dai et al. 2011) could also be employed for analysis by Yang et al. (2012). It will be argued that the filter chosen to delimit the data is inappropriate for investigating solid waste research and generates misleading results.

Our results showed that there were 9,348 papers related to solid waste research from 1997 to 2011, including 13 document types. Articles (7,913) comprised 85 % of the total production, followed distantly by proceedings papers (809; 8.7 %), reviews (397; 4.3 %), editorial materials (99; 1.1 %) and meeting abstracts (73; 0.78 %). The others with less significance were news item (28), letters (10), corrections (12), book chapter (2), reprints (1), book review (3), and correction additions (1). Because of the great difference in data, the same analyzed items of Tables and Figures presented in the Yang et al. (2012) were reproduced here to show the impact of inappropriate search, using "solid waste*" as topic.

Table 4 Top 20 journals with the most articles during 1997–2011

Journals	TA
Waste Management	725
Waste Management and Research	436
Journal of Hazardous Materials	386
Bioresource Technology	370
Resources Conservation and Recycling	245
Chemosphere	224
Environmental Science and Technology	192
Compost Science and Utilization	106
Journal of the Air and Waste Management Association	99
Journal of Environmental Management	90
Science of the Total Environment	90
Environmental Technology	84
Journal of Environmental Engineering-ASCE	79
Water Research	71
Environmental Monitoring and Assessment	68
Fresenius Environmental Bulletin	65
Environmental Engineering Science	64
Fuel	60
Journal of Geotechnical and Geoenvironmental Engineering	58
Journal of Environmental Sciences—China	55

The annual amount of articles decreased significantly during 1997–2011 (Table 2), in comparison with the results from Yang et al. (2012). The growth patterns of the progression from 1997 to 2011 were simulated by a linear model with coefficient of determination ($R^2 = 0.9589$) (Fig. 1). Compared to 146 countries/territories given by Yang et al. (2012), the actual number of countries/territories participating in the research was 120, increasing from a number of 46 in 1997 to 83 in 2011 (Fig. 2). Comparison between G7 (Canada, France, Japan, Germany, Italy, the UK, and the USA) and BRIC (Brazil, Russia, India, and China) countries on the number and percentage of articles was demonstrated in Fig. 3 with a more understandable expression. In Table 3, Denmark and Malaysia did not appear in the list of top 20 countries given by Yang et al. (2012). Although the rankings of the top four countries were the same, the publication output of each country was much smaller according to our study. In Table 4, seven journals, i.e. *Compost Science and Utilization, Journal of the Air and Waste Management Association, Journal of Environmental Management, Environmental Monitoring and Assessment, Fuel, Journal of Geotechnical and Geoenvironmental Engineering, Journal of Environmental Sciences-China* did not appear in the list of top 20 journals given by Yang et al. (2012). The two lists coincide only on the top one journal, *Waste Management*. In Table 5, the 12 most frequently used author keywords including municipal solid waste (including municipal solid waste (MSW)), compost, solid waste management (including SWM), kinetics, solid wastes, sewage sludge, heavy metal, uncertainty, waste, landfills, bottom ash and combustion did not appear in the list of top 30 most frequency of author keywords by Yang et al. (2012). In Table 6, municipal solid-waste, water, sewage-sludge, systems, emissions,

Table 5 Top 30 most frequency of author keywords used for every 5-year period

Author keywords	1997–2011 TA	1997–2011 (%)	1997–2001 *R* (%)	2002–2006 *R* (%)	2007–2011 *R* (%)
Municipal solid waste	700	12	1 (15)	1 (11)	1 (12)
Solid waste	363	6.2	3 (7.0)	2 (7.0)	2 (5.6)
Heavy metals	281	4.8	4 (5.5)	3 (5.8)	4 (4.1)
Anaerobic digestion	271	4.6	11 (3.3)	8 (3.6)	3 (5.6)
Landfill	266	4.5	2 (7.1)	4 (5.3)	5 (3.5)
Recycling	204	3.5	5 (5.4)	7 (3.6)	10 (2.9)
Compost	198	3.4	8 (4.1)	9 (3.5)	8 (3.1)
Composting	195	3.3	7 (4.6)	15 (2.6)	6 (3.3)
Adsorption	173	2.9	24 (1.5)	10 (3.4)	9 (3.1)
Waste management	173	2.9	19 (1.7)	13 (3.1)	7 (3.2)
Fly ash	171	2.9	13 (2.4)	5 (3.7)	12 (2.7)
Leachate	170	2.9	6 (4.7)	6 (3.6)	16 (2.1)
Incineration	143	2.4	10 (3.7)	11 (3.3)	19 (1.7)
Solid waste management	140	2.4	9 (4.1)	16 (2.2)	17 (2.0)
Biogas	132	2.2	20 (1.6)	19 (1.6)	11 (2.7)
Leaching	126	2.1	12 (2.8)	12 (3.1)	21 (1.6)
Environment	115	2.0	21 (1.6)	29 (1.3)	14 (2.3)
Kinetics	103	1.8	67 (0.7)	21 (1.6)	15 (2.1)
Solid wastes	102	1.7	17 (1.8)	14 (3.0)	32 (1.1)
Sewage sludge	100	1.7	15 (2.1)	22 (1.6)	20 (1.6)
Heavy metal	99	1.7	35 (1.2)	20 (1.6)	18 (1.9)
Uncertainty	99	1.7	158 (0.5)	51 (0.8)	13 (2.4)
Methane	92	1.6	22 (1.6)	25 (1.5)	22 (1.6)
Pyrolysis	81	1.4	14 (2.2)	26 (1.5)	34 (1.1)
Biomass	77	1.3	26 (1.4)	18 (1.7)	33 (1.1)
Waste	76	1.3	23 (1.6)	37 (1.1)	24 (1.3)
Landfills	74	1.3	18 (1.7)	17 (1.8)	40 (0.9)
Bottom ash	73	1.2	33 (1.2)	24 (1.5)	30 (1.1)
Activated carbon	72	1.2	39 (1.0)	23 (1.5)	28 (1.1)
Combustion	72	1.2	16 (1.8)	28 (1.3)	36 (1.0)

kinetics, waste, soils, organic-matter, incineration, decomposition and speciation, which were the 12 most frequent *Keywords Plus*, did not appear in that of Yang et al. (2012). The data presented in our Tables differed significantly from those by Yang et al. (2012), thus, further analysis and discussion from Yang et al. (2012) might be debatable.

For subject category analysis, Yang et al. mentioned in the article that "There was a great diversity including 100 subject categories related to the research topic of solid waste in Journal Citation Reports (JCR)". But it is strange because we cannot locate the same subject categories according to Journal Citation Reports (JCR) science edition (2011). We speculated that they used the "research areas" presented in the Web of Science instead of subject categories in JCR. We listed the top 20 Web of Science categories with the most

Table 6 Top 30 most frequency of *Keywords Plus* used for 5-year periods

Keywords plus	1997–2011 TA	1997–2011 (%)	1997–2001 *R* (%)	2002–2006 *R* (%)	2007–2011 *R* (%)
Municipal solid-waste	914	14	1 (7.5)	1 (12)	1 (17)
Solid-waste	507	7.9	5 (4.8)	2 (7.2)	2 (8.9)
Water	422	6.5	6 (4.6)	3 (6.6)	3 (6.9)
Sewage-sludge	362	5.6	4 (4.9)	9 (4.3)	4 (6.4)
Heavy-metals	354	5.5	2 (5.1)	5 (5.9)	6 (5.4)
Soil	306	4.7	7 (4.1)	4 (6.0)	9 (4.4)
Management	303	4.7	31 (1.9)	14 (3.6)	5 (5.8)
Fly-ash	301	4.7	3 (4.9)	6 (5.4)	11 (4.3)
Behavior	275	4.3	9 (3.9)	8 (4.4)	10 (4.3)
Removal	266	4.1	40 (1.6)	7 (4.4)	8 (4.6)
Degradation	251	3.9	10 (3.6)	12 (3.8)	13 (4.0)
Model	249	3.9	12 (3.4)	23 (2.4)	7 (4.6)
Combustion	229	3.6	13 (3.2)	10 (4.2)	17 (3.4)
Sludge	227	3.5	14 (2.7)	15 (3.3)	14 (3.8)
Systems	216	3.4	54 (1.2)	22 (2.5)	12 (4.2)
Adsorption	213	3.3	45 (1.4)	11 (4.0)	16 (3.4)
Emissions	212	3.3	19 (2.4)	13 (3.8)	18 (3.3)
Biomass	194	3.0	62 (1.0)	21 (2.6)	15 (3.7)
Kinetics	178	2.8	33 (1.8)	18 (2.7)	23 (3.0)
Temperature	178	2.8	20 (2.4)	38 (1.8)	20 (3.3)
Carbon	169	2.6	18 (2.4)	17 (2.9)	29 (2.6)
Anaerobic-digestion	164	2.5	41 (1.5)	35 (1.8)	21 (3.1)
Waste	164	2.5	27 (2.0)	39 (1.7)	22 (3.0)
Performance	161	2.5	121 (0.7)	44 (1.7)	19 (3.3)
Soils	160	2.5	8 (4.0)	25 (2.4)	34 (2.2)
Organic-matter	157	2.4	32 (1.9)	37 (1.8)	24 (2.8)
Sorption	157	2.4	49 (1.4)	20 (2.6)	28 (2.6)
Incineration	154	2.4	30 (1.9)	28 (2.2)	30 (2.6)
Decomposition	150	2.3	21 (2.3)	19 (2.6)	33 (2.2)
Speciation	146	2.3	25 (2.0)	16 (3.0)	40 (2.0)

articles for 5-year periods in Table 7. The top six Web of Science categories with the most articles agreed with the results from Fu et al. (2010). Environmental sciences and environmental engineering ranked the first and the second respectively, while the ranking of the other four Web of Science categories differed slightly.

In sum, inappropriate use of non-alphabetic characters in search filters could have enormous effects on the results, which, in the case of Yang et al. (2012), was the omission of quotation marks. Great attention should be paid to the appropriate use of non-alphabetic characters in search filter.

Table 7 Top 20 Web of Science categories with the most articles for 5-year periods

Web of Science categories	1997–2011 TA	1997–2011 (%)	1997–2001 *R* (%)	2002–2006 *R* (%)	2007–2011 *R* (%)
Environmental sciences	4,196	53	1 (49)	1 (52)	1 (55)
Environmental engineering	2,751	35	2 (31)	2 (33)	2 (37)
Energy and fuels	877	11	4 (8.8)	4 (8.6)	3 (13)
Biotechnology and applied microbiology	757	9.6	5 (7.0)	5 (7.7)	4 (11)
Chemical engineering	734	9.3	3 (11)	3 (10)	5 (8.5)
Civil engineering	597	7.5	7 (5.7)	6 (7.5)	6 (8.1)
Agricultural engineering	447	5.6	11 (3.9)	11 (3.4)	7 (7.3)
Water resources	413	5.2	8 (5.6)	7 (4.8)	8 (5.3)
Soil science	292	3.7	6 (6.2)	8 (4.7)	11 (2.5)
Multidisciplinary geosciences	275	3.5	9 (5.0)	9 (4.0)	9 (2.7)
Ecology	231	2.9	10 (4.4)	10 (3.7)	12 (2.1)
Meteorology and atmospheric sciences	194	2.5	13 (3.4)	12 (3.2)	17 (1.8)
Multidisciplinary chemistry	192	2.4	17 (1.9)	15 (2.5)	10 (2.6)
Multidisciplinary materials science	183	2.3	16 (2.2)	13 (2.9)	13 (2.0)
Analytical chemistry	182	2.3	12 (3.4)	14 (2.8)	18 (1.7)
Applied chemistry	165	2.1	15 (2.4)	18 (2.1)	14 (2.0)
Geological engineering	155	2.0	14 (2.7)	16 (2.2)	21 (1.6)
Physical chemistry	146	1.8	23 (1.3)	19 (2.0)	15 (1.9)
Public environmental and occupational health	133	1.7	28 (1.1)	17 (2.1)	20 (1.6)
Environmental studies	128	1.6	29 (1.0)	23 (1.4)	16 (1.9)

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