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LETTER TO THE EDITOR

Comments on "Research on sulfur oxides and nitric oxides released from coal-fired flue gas and vehicle exhaust: a bibliometric analysis" by Wang et al. (2019)

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Wang et al. (2019) recently published a paper in *Environmental Science and Pollution Research* entitled "Research on sulfur oxides and nitric oxides released from coal-fired flue gas and vehicle exhaust: a bibliometric analysis." The authors of this paper stated in section Data sources that "the online version of the Science Citation Index (SCI), Web of Science is most often chosen for bibliometric research in natural sciences because of its comprehensiveness and high quality."

In fact, there is no "Science Citation Index (SCI), Web of Science" but the Science Citation Index Expanded (SCI-EXPANDED), Web of Science of Clarivate Analytics (formerly known as the Thomson Reuters and the Institute for Scientific Information).

In the same section, Wang et al. (2019) stated that "The research was conducted for the terms of sulfur oxides and nitric oxides within the publication years 1986 to 2011, with the specific search function (sulfur* OR nitric*) AND (flue gas OR exhaust*). Altogether, 5185 publications from 1995 to 2018 met the selection criteria." Authors searched publications from "1986 to 2011." However, they obtained 5185 publications from "1995 to 2018."

Using the same method as mentioned in the original paper (Wang et al. 2019) and using (sulfur* OR nitric*) AND (flue gas OR exhaust*) as keywords within the publication years 1986 to 2018 resulted 6458 documents including 6019 articles. Compared with the original paper (Wang et al. 2019), there was a total of 1273 (25% of the 5185 documents) difference. It is obvious that when (sulfur* OR nitric*) AND (flue gas OR exhaust*), which means (sulfur* OR nitric*) AND ((flue and gas) OR exhaust*), was searched in the Topic, is inappropriate for "Research on sulfur oxides and nitric oxides released from coal-fired flue gas and vehicle exhaust: a bibliometric analysis." Furthermore, keywords "sulfuretin," "sulfurihydrogenibium," "sulfuric," "exhauster," "exhaustibility," "exhaustible," "exhaustion," "exhaustively," "exhausted," and "exhaustive" might not be appropriate. In addition, "flue gasses" and "flue gases" are missing in the original paper (Wang et al. 2019).

The SCI-EXPANDED is designed mainly for researchers to find published literatures, not for bibliometric studies (Ho 2018a, b). Hence, using SCI-EXPANDED with an accurate bibliometric method is critical for all researchers (Ho 2018a, b). The documents searched out by *KeyWords Plus* were irrelevant to "sulfur oxides and nitric oxides released from coal-fired flue gas and vehicle exhaust" (Fu and Ho 2015). Due to biases from the SCI-EXPANDED, Ho's group was the first to propose "front page" (including the article title, the abstract, and the author keywords) as a filter to improve the bibliometric method (Fu et al. 2012; Fu and Ho 2014; Ho and Fu 2016). Based on keywords by authors, ("sulfuration" or "sulfuryl" or "sulfurization" or "sulfuratus" or "sulfurdioxide" or "sulfurous" or "sulfur" or "nitric") and ("flue gases" or "flue gas" or "flue gasses" or "exhaust" or "exhausts" or "exhausting") can be an accurate search strategy.

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Table 1 Document type of publications

Document type	*TP*	%	*AU*	*APP*	TC_{2018}	CPP_{2018}
Article	2746	95	12,000	4.4	59,520	22
Proceedings paper	243	8.4	931	3.8	6073	25
Review	99	3.4	391	3.9	10,593	107
Meeting abstract	18	0.63	88	4.9	2	0.11
Note	9	0.31	31	3.4	451	50
Letter	4	0.14	10	2.5	131	33
Editorial material	3	0.10	7	2.3	1	0.33
Book chapter	2	0.069	4	2.0	15	7.5
Correction	1	0.035	5	5.0	1	1.0

TP, number of publications; *AU*, number of authors; *APP*, number of authors per publication; TC_{2018}, the total number of citations from Web of Science Core Collection since publication to the end of 2018; CPP_{2018}, number of citations (TC_{2018}) per publication (*TP*)

Wang et al. (2019) stated in section Research tendency and hotspots, that "Research tendency and hotpots were studied by word statistical analysis, which meant that we divided the title and author keyword into single words and did statistical analysis to help us find the possible research tendency and hotspots." The authors copied this idea from others without any citations. Ho's group proposed the idea and method to find research hotspots and their development trends (Mao et al. 2010; Wang and Ho 2016).

Table 2 Language of publications

Language	*TP*	%	*AU*	*APP*	TC_{2018}	CPP_{2018}
English	2647	96	11,662	4.4	59,315	22
Chinese	23	0.84	111	4.8	63	2.7
Japanese	23	0.84	93	4.0	34	1.5
Polish	19	0.69	51	2.7	27	1.4
German	18	0.66	42	2.3	55	3.1
French	6	0.22	16	2.7	19	3.2
Slovene	2	0.073	4	2.0	1	0.50
Spanish	2	0.073	7	3.5	3	1.5
Turkish	2	0.073	3	1.5	3	1.5
Czech	1	0.036	4	4.0	0	0
Hungarian	1	0.036	1	1.0	0	0
Portuguese	1	0.036	3	3.0	0	0
Russian	1	0.036	3	3.0	0	0

TP, total number of articles; *AU*, number of authors; *APP*, number of authors per article; TC_{2018}, the total number of citations from Web of Science Core Collection since publication to the end of 2018; CPP_{2018}, number of citations (TC_{2018}) per article (*TP*)

In section Distribution of paper title analysis, Wang et al. (2019) stated that "The title of an article always contains the most important message that the author wants to express to the readers. Thus, we divided the title into single words and did statistical analysis. During the analysis, some empty words, including "the," "a," "an," "and," and "with," were ignored. We made each 8 years a period (1995–2002, 2003–2010, and 2011–2018) to statistically analyze the title words, and the number of different title words of the three periods was 95, 20,414, and 39,323, respectively." The authors copied the idea from publications by Ho's group (Li et al. 2009; Zhang et al. 2010; Mao et al. 2010) without any citations.

Finally, using a more accuracy method with SCI-EXPANDED from 1991 to 2018 and using searching keywords ("sulfuration" or "sulfuryl" or "sulfurization" or "sulfuratus" or "sulfurdioxide" or "sulfurous" or "sulfur" or "nitric") and ("flue gases" or "flue gas" or "flue gasses" or "exhaust" or "exhausts" or "exhausting") for "Research on sulfur oxides and nitric oxides released from coal-fired flue gas and vehicle exhaust: a bibliometric analysis" resulted 5334 documents including 5018 articles. A number of documents searched from SCI-EXPANDED and a number of documents with the same searched keywords in "front page" of documents were not the same. Only 2880 documents (54% of the 5334 documents) including 2746 articles (55% of the 5018 articles) were found by using "front page" as a filter. These results show a huge difference from the method without using the "front page" as a filter. All related results were presented in tables and figures.

Document types of "article; proceedings paper," "review; book chapter," "article; book chapter," and "proceedings paper; retracted publication" in Table 1 in the original paper (Wang et al. 2019) are not identified as document types in the Web of Science Core Collections but "articles," "proceedings papers," "reviews," "book chapter," "book chapter," and "retracted publication." Ho's group proposed a table to compare the characteristics of different document types (Ho et al. 2018). Table 1 shows document type of publications with numbers of author per publication (*APP*), total citations from Web of Science Core Collections since publication to the end of 2018 (TC_{2018}) (Wang et al. 2011; Chuang et al. 2011), and citations per publications (CPP_{2018}) (Ho 2012). Characteristics of articles and used language was presented in Tables 2 and 3.

Web of Science categories of "energy & fuels; engineering, chemical," "engineering, environmental; environmental sciences," "chemistry, physical; engineering, environmental; engineering, chemical," "engineering, environmental; engineering, chemical," "environmental sciences; meteorology & atmospheric sciences," and "chemistry, applied; chemistry,

Table 3 Characteristics of articles published in SCI-EXPANDED from 1991 to 2019

Year	*TP*	*AU*	*AU/TP*	*NR*	*NR/TP*	*PG*	*PG/TP*	TC_{2018}	CPP_{2018}
1991	27	76	2.8	353	13	222	8.2	353	13
1992	37	105	2.8	659	18	420	11	778	21
1993	46	135	2.9	902	20	463	10	1355	29
1994	54	173	3.2	1074	20	514	9.5	1103	20
1995	58	214	3.7	1154	20	535	9.2	1833	32
1996	75	274	3.7	1692	23	738	9.8	2299	31
1997	49	195	4.0	1188	24	452	9.2	1703	35
1998	87	357	4.1	2012	23	775	8.9	2444	28
1999	68	246	3.6	1620	24	618	9.1	2625	39
2000	71	273	3.8	1793	25	676	9.5	2350	33
2001	84	331	3.9	1830	22	762	9.1	2823	34
2002	68	269	4.0	1458	21	615	9.0	1867	27
2003	84	353	4.2	1642	20	744	8.9	2404	29
2004	89	346	3.9	2504	28	824	9.3	3263	37
2005	86	375	4.4	2237	26	812	9.4	2665	31
2006	86	358	4.2	2205	26	747	8.7	2699	31
2007	131	533	4.1	3318	25	1145	8.7	3784	29
2008	100	430	4.3	2559	26	910	9.1	2697	27
2009	130	571	4.4	3565	27	1109	8.5	3016	23
2010	135	631	4.7	4042	30	1217	9.0	3517	26
2011	122	534	4.4	4048	33	1157	9.5	3259	27
2012	132	613	4.6	4572	35	1192	9.0	2850	22
2013	140	603	4.3	4663	33	1238	8.8	2358	17
2014	153	724	4.7	5541	36	1495	9.8	2085	14
2015	155	780	5.0	5699	37	1533	9.9	1575	10
2016	153	779	5.1	5890	38	1474	9.6	1104	7.2
2017	174	900	5.2	7011	40	1734	10	610	3.5
2018	152	822	5.4	6153	40	1555	10	101	0.66
Total	2746	12,000		81,384		25,676		59,520	
Average			4.4		30		9.4		22

TP, total number of articles; *AU*, number of authors; *AU/TP*, number of authors per article; *PG*, page count; *PG/TP*, page count per article; *NR*, cited reference count; *NR/TP*, cited reference count per article; TC_{2018}, the total number of citations from Web of Science Core Collection since publication to the end of 2018; CPP_{2018}, number of citations (TC_{2018}) per publication (*TP*)

Table 4 Top 10 productive Web of Science categories

Web of Science categories	*TP*	%	No. Journals
Chemical Engineering	1025	37	138
Environmental Sciences	738	27	250
Energy and Fuels	641	23	103
Environmental Engineering	539	20	52
Physical Chemistry	305	11	148
Meteorology and Atmospheric Sciences	241	8.8	86
Mechanical Engineering	163	5.9	129
Thermodynamics	156	5.7	60
Applied Chemistry	130	4.7	71
Multidisciplinary Chemistry	115	4.2	172

TP, total number of articles; *No. Journals*, number of journals in a category

physical; engineering, chemical" in Table 4 in the original paper (Wang et al. 2019) are not identified as Web of Science categories in the Web of Science Core Collections but "energy and fuels," chemical engineering," "environmental engineering," "environmental sciences," "physical chemistry," "environmental sciences," "meteorology and atmospheric sciences," "applied chemistry," and "physical chemistry." Tables 4 and 5 show the top ten productive Web of Science categories and the 20 most published journals respectively. Table 6 presented the top ten productive countries.

In order to study research focuses and their development trends, Ho's group proposed distributions of article titles and abstracts, author keywords, and *KeyWords Plus* of different periods to determine research foci and trends (Zhang et al. 2010; Mao et al. 2010; Wang and Ho 2016). Tables 7 and 8 show the top 30 most frequently used title words and the top 31 most frequently used author keywords used during 1991–2018 and four 7-year periods.

Table 5 The top 20 most published journals

Journals	*TP* (%)	IF_{2018}	TC_{2018}	CPP_{2018}
Energy & Fuels	153 (5.6)	3.021	3331	22
Fuel	122 (4.4)	5.128	3300	27
Environmental Science & Technology	118 (4.3)	7.149	4895	41
Applied Catalysis B-Environmental	83 (3.0)	14.229	4417	53
Industrial & Engineering Chemistry Research	83 (3.0)	3.375	1635	20
Journal of the Air & Waste Management Association	78 (2.8)	1.858	1513	19
Atmospheric Environment	72 (2.6)	4.012	2922	41
Chemical Engineering Journal	56 (2.0)	8.355	1110	20
Fuel Processing Technology	54 (2.0)	4.507	1174	22
Journal of Hazardous Materials	41 (1.5)	7.650	1241	30
Catalysis Today	35 (1.3)	4.888	1467	42
Journal of Engineering for Gas Turbines and Power-Transactions of the ASME	34 (1.2)	1.653	230	6.8
Chemosphere	33 (1.2)	5.108	883	27
Geophysical Research Letters	32 (1.2)	4.578	1325	41
Applied Energy	29 (1.1)	8.426	783	27
Atmospheric Chemistry and Physics	24 (0.87)	5.668	1513	63
Combustion Science and Technology	22 (0.80)	1.564	186	8.5
Journal of Geophysical Research-Atmospheres	22 (0.80)	3.633	830	38
International Journal of Greenhouse Gas Control	21 (0.76)	3.231	363	17
Science of the Total Environment	21 (0.76)	5.589	837	40

TP, total number of articles; IF_{2018}, journal impact factor in 2018; TC_{2018}, the total number of citations from Web of Science Core Collection since publication to the end of 2018; CPP_{2018}, number of citations (TC_{2018}) per publication (*TP*)

In recent years, Ho's group proposed a relationship between total number of articles in a year (*TP*) and their citations per publication ($CPP_{2018} = TC_{2018}/TP$) by the years in a research field as a unique indicator for environmental research topics, for example, bioaccumulation (Lei et al. 2018) and wind tunnel (Mo et al. 2018). Figure 1 shows number of articles and citations per publication by year. Figure 2 presented development of the top four Web of Science categories with total number articles above 500.

Table 6 Top ten productive countries

Country	*TP*	*TP* rank (%)	TC_{2018}	CPP_{2018}
USA	774	1 (28)	22,253	29
China	621	2 (23)	9851	16
Japan	211	3 (7.7)	5365	25
Germany	199	4 (7.3)	5300	27
South Korea	103	5 (3.8)	2196	21
Canada	96	6 (3.5)	1834	19
UK	83	7 (3.0)	3353	40
Poland	78	8 (2.9)	578	7.4
India	75	9 (2.7)	1399	19
Sweden	75	9 (2.7)	1840	25

TP, total number of articles; TC_{2018}, the total number of citations from Web of Science Core Collection since publication to the end of 2018; CPP_{2018}, number of citations (TC_{2018}) per publication (*TP*)

Wang et al. published a bibliometric article in *Environmental Science and Pollution Research* with the use of inappropriate methods. Therefore, their results and discussions may be misleading for journal readers. When a scientific publication duplicates previously published ideas, texts, equations and/or figures without any reference to the previous literature, it is frequently regarded as a sign of possible plagiarism (Hunter 1994; Noè and Batten 2006). From my view, Wang et al. should have cited these earlier works in their paper and thereby provided greater accuracy and information about the concepts and the methods that they employed in their particular field.

Table 7 Top 30 most frequently used title words

Words in title	*TP*	91–18 *R* (%)	91–97 *R* (%)	98–04 *R* (%)	05–11 *R* (%)	12–18 *R* (%)
gas	554	1 (20)	5 (10)	1 (20)	1 (21)	1 (24)
flue	432	2 (16)	13 (6.4)	3 (16)	3 (16)	2 (18)
diesel	397	3 (14)	23 (4.6)	4 (13)	2 (17)	3 (17)
sulfur	379	4 (14)	1 (15)	5 (12)	6 (14)	4 (14)
exhaust	378	5 (14)	4 (10)	2 (17)	5 (15)	6 (13)
emissions	353	6 (13)	9 (8.1)	10 (11)	4 (16)	5 (13)
removal	285	7 (10)	6 (10)	6 (11)	9 (12)	10 (8.8)
engine	276	8 (10)	51 (2.3)	13 (8.3)	8 (13)	7 (11)
combustion	275	9 (10)	19 (4.9)	15 (7.8)	7 (13)	8 (10)
oxide	249	10 (9.1)	9 (8.1)	6 (11)	11 (9.2)	11 (8.1)
SO_2	243	11 (8.8)	14 (6.1)	13 (8.3)	10 (9.4)	9 (10)
nitric	224	12 (8.2)	11 (6.6)	9 (11)	12 (8.6)	13 (7.0)
reduction	210	13 (7.6)	3 (10)	8 (11)	15 (7.0)	22 (5.6)
desulfurization	201	14 (7.3)	8 (8.4)	17 (5.8)	16 (6.8)	11 (8.1)
dioxide	184	15 (6.7)	29 (4.0)	16 (7.3)	14 (7.2)	14 (6.9)
nox	168	16 (6.1)	23 (4.6)	12 (8.9)	20 (5.4)	21 (5.7)
fuel	159	17 (5.8)	34 (3.5)	27 (4.5)	13 (7.6)	20 (5.9)
emission	154	18 (5.6)	23 (4.6)	23 (5.1)	19 (5.8)	18 (6.0)
catalytic	153	19 (5.6)	15 (5.5)	11 (9.1)	23 (5.1)	31 (4.2)
mercury	146	20 (5.3)	218 (0.58)	24 (4.9)	18 (6.2)	16 (6.4)
effects	144	21 (5.2)	26 (4.3)	34 (4.0)	21 (5.3)	17 (6.1)
effect	142	22 (5.2)	15 (5.5)	32 (4.2)	17 (6.7)	27 (4.4)
oxidation	136	23 (5.0)	30 (3.8)	29 (4.4)	21 (5.3)	23 (5.4)
carbon	127	24 (4.6)	39 (2.9)	39 (3.4)	29 (3.7)	15 (6.5)
process	122	25 (4.4)	51 (2.3)	27 (4.5)	37 (3.2)	18 (6.0)
catalyst	117	26 (4.3)	34 (3.5)	17 (5.8)	28 (4.1)	33 (3.9)
coal	116	27 (4.2)	26 (4.3)	34 (4.0)	25 (4.8)	33 (3.9)
catalysts	115	28 (4.2)	11 (6.6)	17 (5.8)	45 (2.8)	37 (3.6)
characteristics	114	29 (4.2)	30 (3.8)	130 (1.1)	23 (5.1)	24 (5.2)
formation	108	30 (3.9)	26 (4.3)	20 (5.6)	34 (3.3)	40 (3.4)

TP, total number of articles; *R*, rank

Table 8 Top 31 most frequently used author keywords

Author keywords	*TP*	91–18 *R* (%)	91–97 *R* (%)	98–04 *R* (%)	05–11 *R* (%)	12–18 *R* (%)
sulfur dioxide	199	1 (11)	1 (20)	2 (10)	1 (12)	1 (9.5)
nitric oxide	154	2 (8.6)	3 (7.4)	1 (13)	2 (11)	2 (5.5)
flue gas	92	3 (5.2)	3 (7.4)	5 (4.3)	3 (5.2)	3 (5.1)
flue gas desulfurization	79	4 (4.4)	2 (10)	27 (1.5)	4 (4.6)	5 (4.5)
combustion	67	5 (3.8)	7 (5.9)	4 (4.6)	6 (3.4)	9 (3.3)
desulfurization	63	6 (3.5)	14 (3.7)	12 (2.7)	7 (3.2)	6 (4)
biodiesel	61	7 (3.4)	N/A	38 (1.2)	5 (3.6)	4 (4.8)
diesel engine	59	8 (3.3)	14 (3.7)	17 (2.1)	11 (2.9)	6 (4)
SO_2	54	9 (3.0)	84 (0.74)	10 (3.0)	14 (2.7)	8 (3.6)
emissions	53	10 (3.0)	14 (3.7)	20 (1.8)	7 (3.2)	10 (3.1)
absorption	51	11 (2.9)	N/A	8 (3.4)	7 (3.2)	12 (2.9)
air pollution	49	12 (2.7)	40 (1.5)	12 (2.7)	11 (2.9)	12 (2.9)
sulfur	48	13 (2.7)	8 (5.2)	12 (2.7)	16 (2.3)	14 (2.5)
nitrogen oxides	47	14 (2.6)	8 (5.2)	17 (2.1)	11 (2.9)	15 (2.3)
NO_x	46	15 (2.6)	10 (4.4)	8 (3.4)	19 (2.1)	15 (2.3)
selective catalytic reduction	44	16 (2.5)	24 (2.2)	3 (5.5)	33 (1.1)	17 (2.1)
ammonia	41	17 (2.3)	20 (3.0)	5 (4.3)	10 (3.1)	42 (0.88)
activated carbon	39	18 (2.2)	24 (2.2)	7 (3.7)	26 (1.7)	19 (1.9)
adsorption	32	19 (1.8)	24 (2.2)	10 (3.0)	33 (1.1)	20 (1.6)
diesel	32	19 (1.8)	24 (2.2)	20 (1.8)	24 (1.9)	20 (1.6)
oxidation	32	19 (1.8)	10 (4.4)	54 (0.91)	24 (1.9)	20 (1.6)
diesel exhaust	31	22 (1.7)	84 (0.74)	15 (2.4)	14 (2.7)	38 (1.0)
mercury	31	22 (1.7)	N/A	38 (1.2)	152 (0.38)	10 (3.1)
particulate matter	28	24 (1.6)	84 (0.74)	54 (0.91)	19 (2.1)	20 (1.6)
nitrogen dioxide	26	25 (1.5)	N/A	20 (1.8)	16 (2.3)	38 (1.0)
fly ash	25	26 (1.4)	84 (0.74)	20 (1.8)	19 (2.1)	42 (0.88)
carbon dioxide	24	27 (1.3)	40 (1.5)	99 (0.61)	19 (2.1)	32 (1.1)
SCR	24	27 (1.3)	N/A	17 (2.1)	44 (1.0)	25 (1.5)
exhaust emissions	23	29 (1.3)	40 (1.5)	54 (0.91)	27 (1.5)	28 (1.3)
kinetics	23	29 (1.3)	20 (3.0)	27 (1.5)	16 (2.3)	206 (0.25)
platinum	23	29 (1.3)	10 (4.4)	38 (1.2)	19 (2.1)	206 (0.25)

TP, total number of articles; *R*, rank

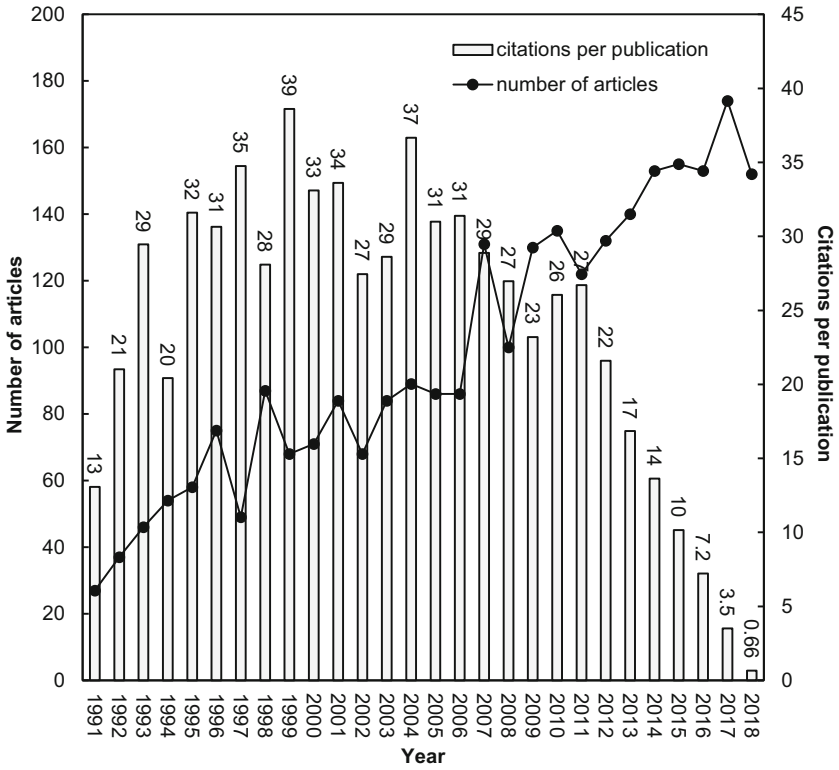

Fig. 1 Number of articles and citations per publication by year

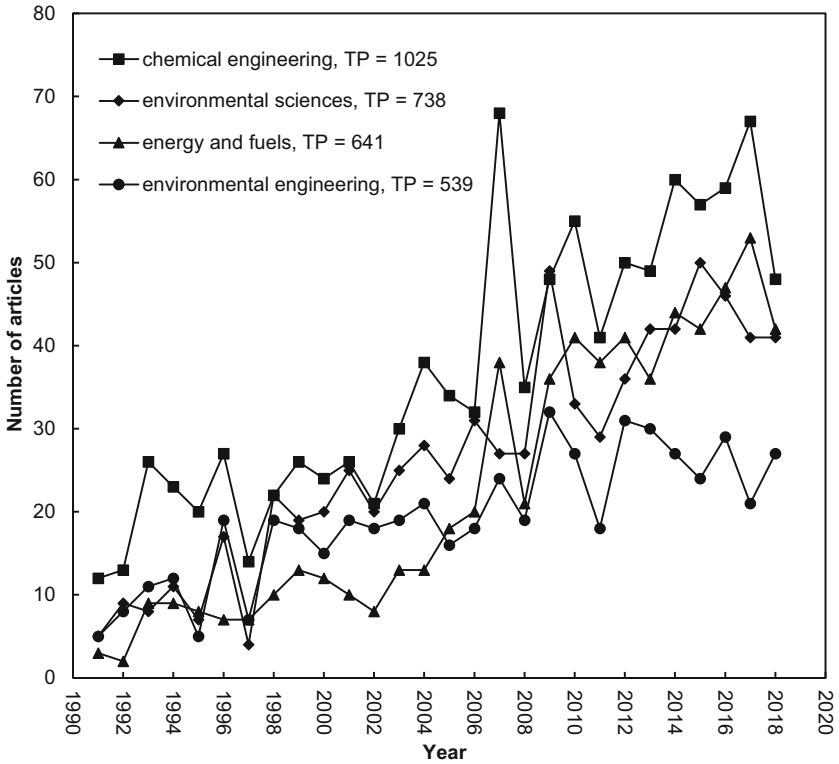

Fig. 2 Top four Web of Science categories with total number articles above 500

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