

e 4th International Electronic Conference pplied Sciences 10 November 2023 I Onlin

Portuguese

Russian

ed by **Dr. Nunzio Cennamo**

I applied sciences

						Corresponding author: 20
1. Introduction		3.2 Top 15	research	areas, institu	ution	s, countries/regions, jourr
As a non-renewable resource, phosphorus enjoys the dual characteristics of polluting and resource. Specifically, polluting refers	No.	Research Areas	Record Count	%	No.	. Affiliations
to excessive phosphorus discharged into the waterbody will lead to eutrophication of the waterbody, thus affecting the water quality,	1	Environmental Sciences Engineering Environmental	2,554 1,324	52.714% 27.327%	- 1	CHINESE ACADEMY OF SCIE
while resource refers to the application of appropriate amount of	3	Water Resources	875	18.060%	-2	TONGJI UNIVERSITY
phosphorus can promote plant growth and improve crop yield.	4	Engineering Chemical	656	13.540%		MINISTRY OF AGRICULTURE
Therefore, how to effectively remove phosphorus from bodies of water and recycle it as a soil conditioner or fertilizer for agricultural	5	Biotechnology Applied Microbiology	523	10.795%		AFFAIRS
land applications has been a hot issue in global research.	6	Energy Fuels	338	6.976%	_ 4	STATE UNIVERSITY SYSTE FLORIDA
	8	Soil Science Agricultural Engineering	280 259	5.779% 5.346%		UNIVERSITY OF CHINES
2. Phosphorus crisis and the wide range of uses of	9	Chemistry Multidisciplinary	239	4.892%		ACADEMY OF SCIENCES (
phosphorus as a resource	10	Green Sustainable Science Technology	234	4.830%	6	UNIVERSITY OF FLORID
Many scholars have modeled the depletion of phosphorus	11	Ecology	148	3.055%	_ 7	HARBIN INSTITUTE OF TECHNOLOGY
resources and discovered that the global phosphorus resource	12	Agronomy	142	2.931%		BEIJING UNIVERSITY O
will be in a shortage within 50~100 years at the current rate of	13	Chemistry Physical	116	2.394%	- 8	TECHNOLOGY
 phosphorus mining and consumption. Phosphorus as a resource is widely used in feed, detergents, 	14	Microbiology Plant Sciences	<u> 111</u> 109	2.291% 2.250%	- 9	UNIVERSITY OF QUEENSL
preservatives, food additives, household chemicals, pesticides,				2.23070		CHINESE ACADEMY O
fertilizers, and electronics.	No.	Journal	Record Count	%		AGRICULTURAL SCIENC
3. Recent advances analysis by bibliometrics	1	SCIENCE OF THE TOTAL ENVIRONMENT	295	6.089%	11	EGYPTIAN KNOWLEDGE BAN
Two types of document (article and review article) published up to	2	BIORESOURCE TECHNOLOGY	227	4.685%	12	UNIVERSITY OF CALIFOR SYSTEM
July 14, 2023 were collected and analyzed from the Web of Science	3	WATER SCIENCE AND	224	4.623%	13	ZHEJIANG UNIVERSITY
core databases and a bibliometric survey was conducted using		TECHNOLOGY CHEMOSPHERE	218	4.499%	- 14	NORTHWEST A F UNIVERS
VOSviewer and Bibliometrix software.	4	WATER RESEARCH	218	4.499%	_ 14	CHINA
Search criteria	6	ENVIRONMENTAL SCIENCE AND	135	2.786%	15	TSINGHUA UNIVERSIT
	0	POLLUTION RESEARCH	155	2.70070	_ No.	. Countries/Regions
Database Keywords Period	7	CHEMICAL ENGINEERING JOURNAL	128	2.642%	1	PEOPLES R CHINA
Web of Science "biochar" OR "bio-char" OR 1990~2023.7.14	8	JOURNAL OF ENVIRONMENTAL	119	2.456%	2	USA
Core Collection"biocarbon" OR "biological carbon" AND "phosphorus"		MANAGEMENT	117	2.43070		AUSTRALIA
OR "phosphate" AND "sorption*" OR "adsorption*"	9	JOURNAL OF CLEANER PRODUCTION	116	2.394%	4	INDIA CANADA
OR "recovery*" OR "reclamation*" OR "recycling* " OR "removal* "	10	ENVIRONMENTAL TECHNOLOGY	82	1.692%	6	SOUTH KOREA
3.1 Publication evolution, top 10 languages	11	DESALINATION AND WATER	81	1.672%	7	SPAIN
		TREATMENT	01	1.07270		GERMANY
	12	JOURNAL OF HAZARDOUS MATERIALS	79	1.631%	10	BRAZIL ENGLAND
	13	JOURNAL OF ENVIRONMENTAL CHEMICAL ENGINEERING	64	1.321%		IRAN
	14	WATER ENVIRONMENT	60	1.238%	-12	FRANCE
i i i i i i i i i i i i i i i i i i i		RESEARCH	00	1.23070	$-\frac{13}{14}$	DENMARK JAPAN
Su 600 - Su 600 - St 519 500 - St 519 418 418	15	JOURNAL OF WATER PROCESS ENGINEERING	59	1.218%	14	
n d d 0 d d d d d d d d d d						
2 200 - ⁰ 2018 2019 2020 2021 2022 2023 Year		3.3	Keywor	d co-occurrer	ice n	etwork, thematic map
100 -		com nitrogen mineralization physical-properties fertility cropyield root				Niche Themes
		amendment yield microbial biomass ecosystems sequential extraction availability litter responses torrefaction long-term				waste-water activated-sludge performance
0 1990 1995 2000 2005 2010 2015 2020		poultry litter phosphorus availability cu poultry litter phosphorus availability cu bioavailability organic-matter plants communities	₅ ecollogy	microbial-		
Year		pb feedstock retention management growth contaminated soils contaminated soils feedstock retention management growth contaminated soils contaminated soils feedstock retention management growth contaminated soils contaminated soils feedstock retention management growth contaminated soils feedstock retention management growth feedstock growth feedstock rates feedstock retention management growth feedstock rates feedstock rates feedstock retention management growth feedstock rates feedstock rates feedstock feedstock rates f	populations munity ratios fish in-sit	acinetobacter rhodocyclus		
4,810 11 4 3	carbon reten feedstoick type	immobilization soil ash release nitrogen microbial community st cadmium competitive adsorption incineration i	ructure sp-nov. al community	abolism tod cludza polyphosphate	jree	
Figure 1Figure 1Figure 1EnglishPolishSpanishFrench	reclaiming phosphate	pyrolysis temperature phosphorus constructed wetlands surface-chemistry biocharce of temperature biocharce ratio	cids granulation glucose time storage	model competition water treatment proces	ment deç ensity)	
	cadmiumiremoval	phosphorus adsorption phosphate Sewage sludge on phosphorus adsorption phosphate sewage sludge stormwater generation sew	^{ludge} biological pho _{vage} denitrification	orp anaerobic	Developr (De	
	engine	eered biochar pb(ii) adsorption water behavior wastewater nitrate removal precipitation water wastewater nitrate removal precipitation water wastewater nitrate removal	sign reactor sbr stem biofilm	organisms nitrite denitrification		
4	adsorp	aqueous-solution recovery oxidation drinking water pretreatment men thermodynamics struvite	anamno abrane bioreactor ial wastewater	x aerobic/extended-idle regime propionic acid mulation		
Chinese 2 1 Eskimo	adsor	nagnetic biochar ption mechanism composite cr(vi) phosphate recovery membrane exce	external carbo ess sludge	n source		
	selective	composites u(vi) efficient mgo carbon nanotubes recycle glassy-carbon electrode swine wastewater • piloteca	simultaneous carbon			Emerging or Declining Themes
4 Portuguese2 Romanian	highly ef	ificient selectivity nanocomposite batch dye isotherm				Relevance (Centr

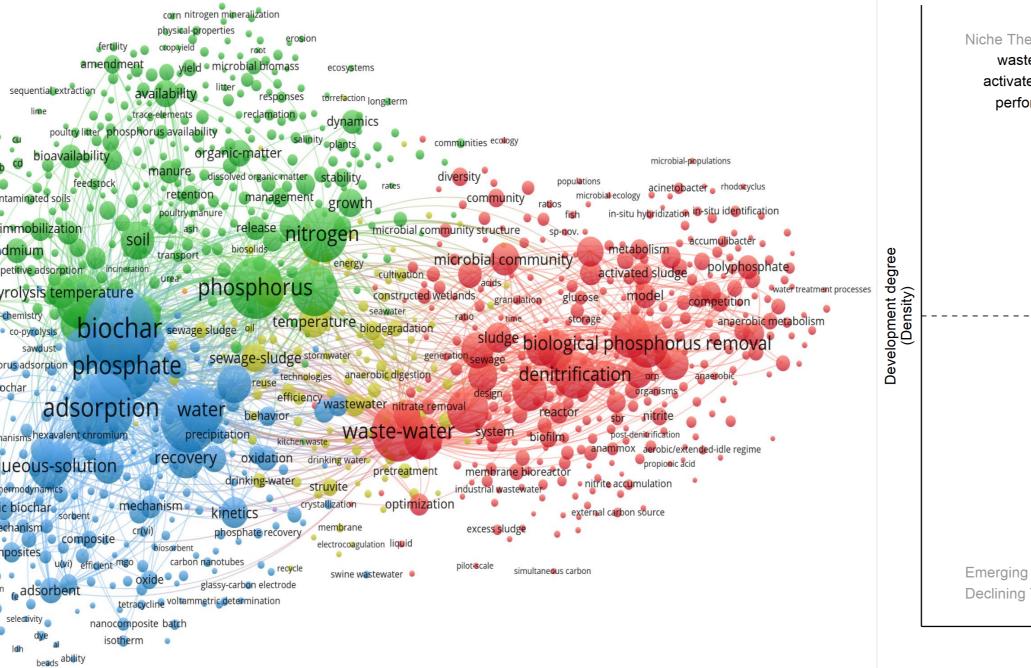
Recent advances and future trends in phosphorus recycling with biochar: A bibliometric analysis

Lei Zhang¹ and Xuefei Zhou^{1,*}

¹ State Key Laboratory of Pollution Control and Resource Reuse, College of Environmental Science and Engineering, Tongji University, Shanghai, 200092, P. R. China * Corresponding author: zhouxuefei@tongji.edu.cn

$\mathbf{D} \mathbf{D} \mathbf{T}_{\mathbf{A}}$	p 15 research areas,				
	n 15 research areas	Institutions	countries/	regions	
				168101137	Jean

thematic map

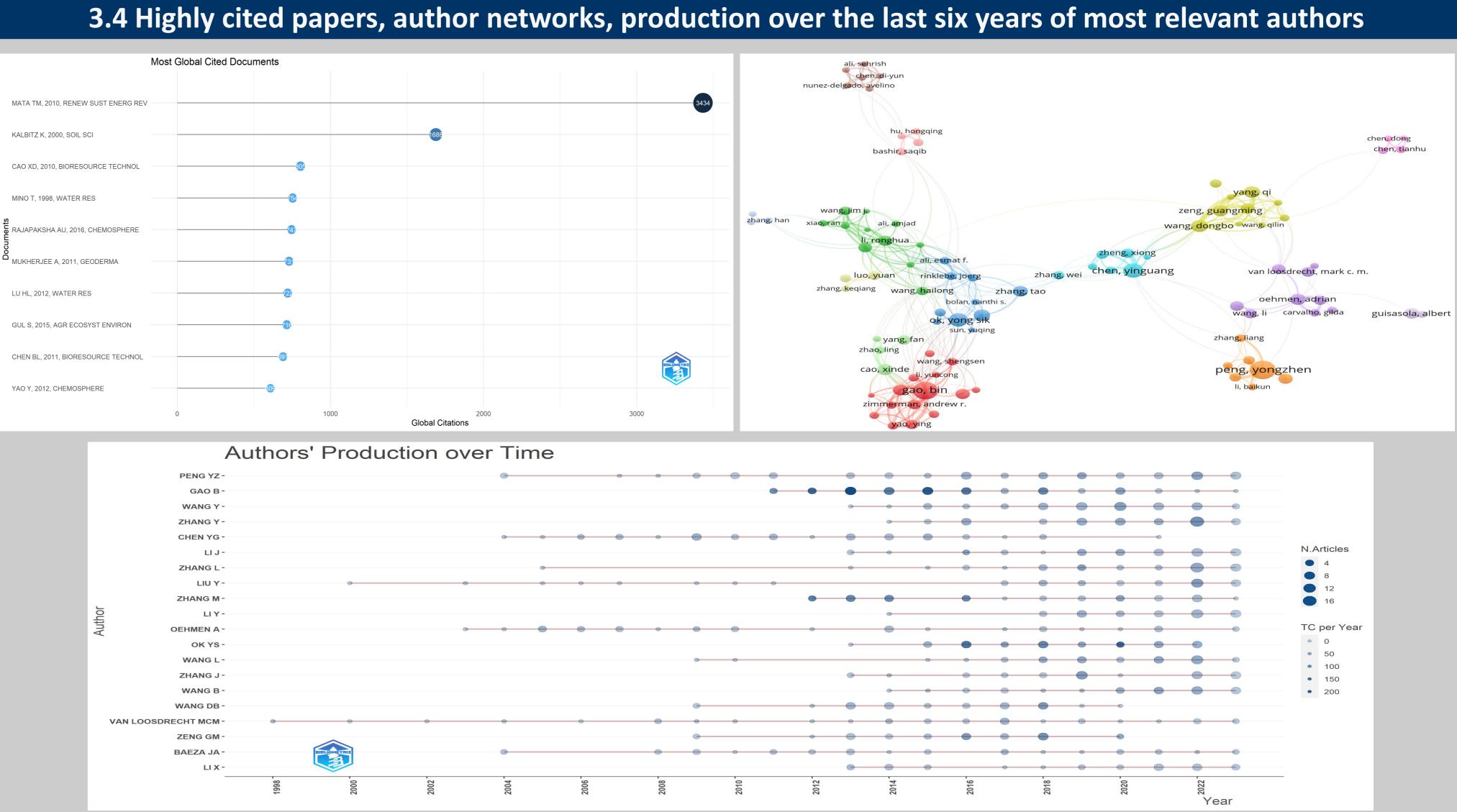


irnals	}				
		Record Count	%		
CIENCES		267	5.511%		
Ϋ́		120	2.477%		
RE RUI	RAL	118	2.436%		
ГЕМ О	F	118	2.436%		
ESE S CAS		96	1.981%		
RIDA		96	1.981%		
OF		88	1.816%		
Y OF		87	1.796%		
SLANI)	85	1.754%		
OF NCES		80	1.651%		
ANK E	EKB	69	1.424%		
ORNIA		65	1.342%		
ITY		64	1.321%		
CRSITY	7	60	1.238%		
ITY		59	1.218%		
	Re	cord Count	0⁄0		
		2,178	44.954%		
		730	15.067%		
		336	6.935%		
		228	4.706%		
		226	4.665%		
		215	4.438%		
	166		3.426%		
	161		3.323%		
	141		2.910%		
	134		2.766%		
	120		2.477%		
	109		2.250%		
		95	1.961%		
		95	1.961%		
		95	1.961%		

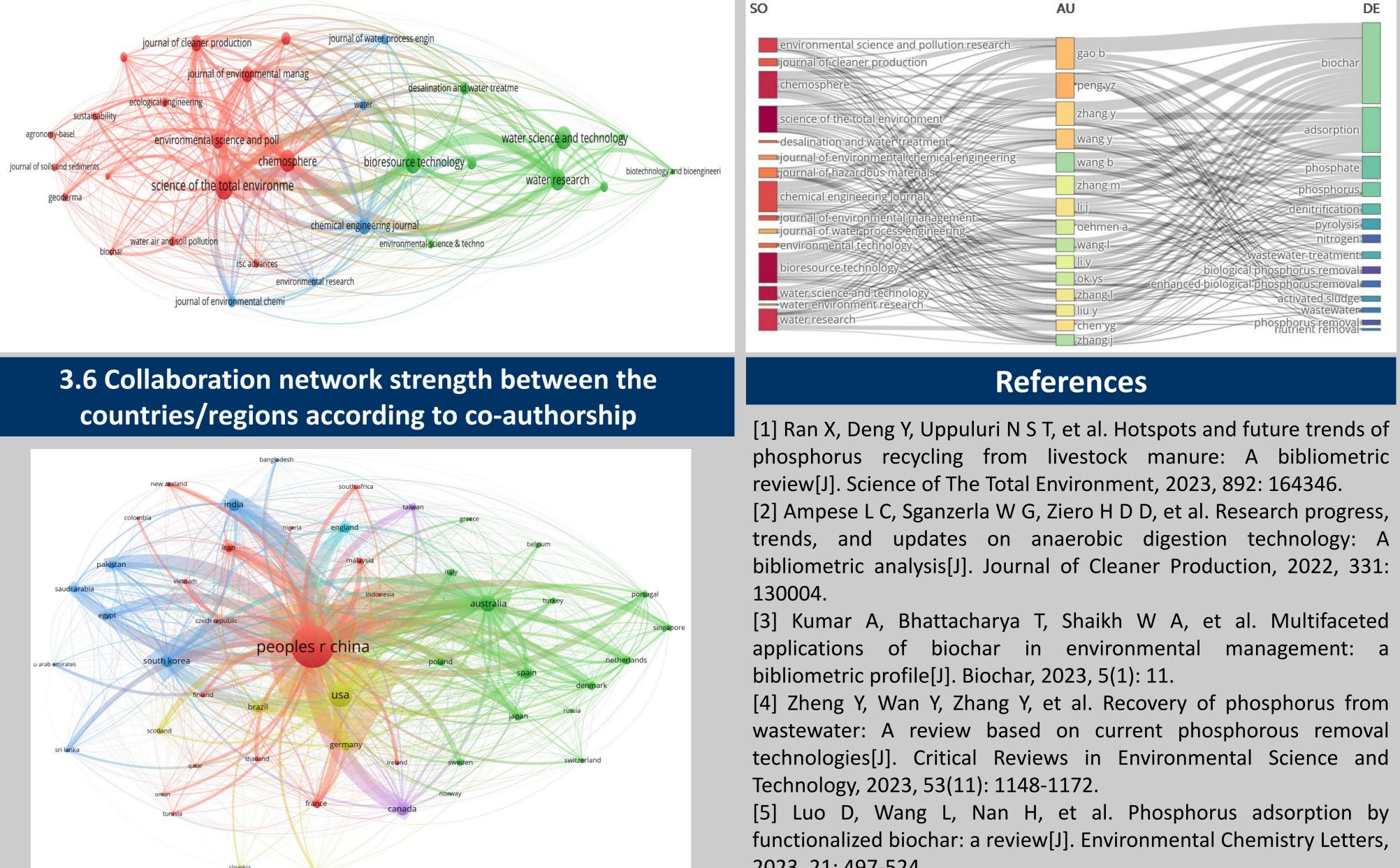
1
Motor Themes
 , , ,
removal
adsorption
phosphate
Basic Themes

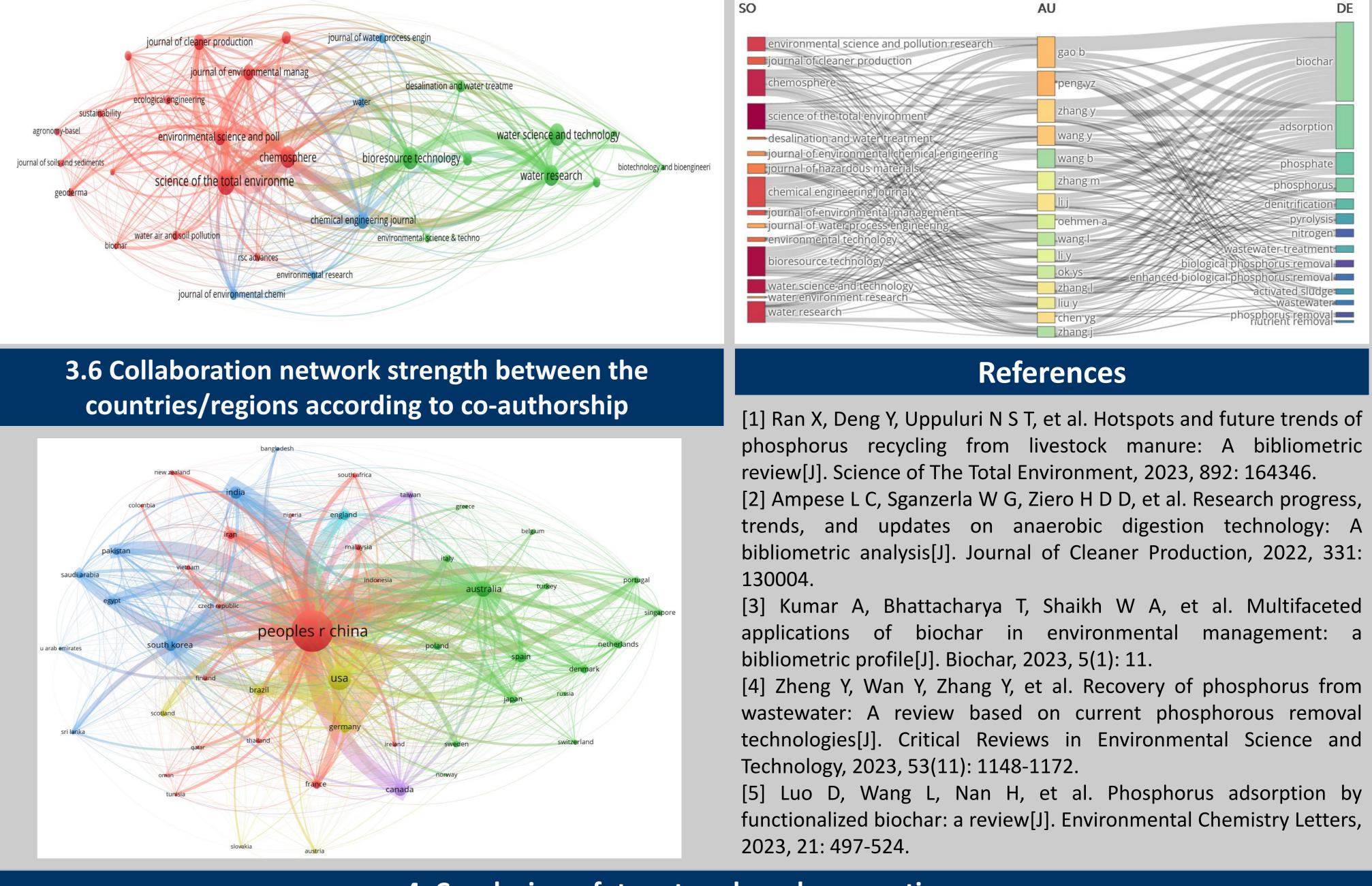
Relevance degree

(Centrality)









4. Conclusions, future trends and perspectives

(1) The number of papers in the field of phosphorus recovery with biochar has been growing rapidly, which proves that the field has attracted the interest of scholars worldwide.

(2) Most of these studies are focused on the field of environmental sciences, with journals such as Science of The Total Environment, Bioresource Technology and Water Science and Technology are the main sources of these studies. (3) Peoples R China publishes the largest number of articles, has the greatest influence, and maintains the closest ties with the rest of the world. (4) Chinese Academy of Sciences is the most published organization followed by Tongji University and Ministry of Agriculture and Rural Affairs. (5) The thematic map analysis shows that removal, adsorption, and phosphate may become the hotspot of research and the direction of future development.

(6) Future research should focus more on improving phosphorus recycling efficiency, exploring the agronomic efficiency and mechanism of action of phosphorus recycling products, and assessing the economic and ecological benefits of the phosphorus recycling process.



3.5 The 30 most expressive journals of publications and the three-fields plot correlating the top 15 journals, authors and authors' keywords