# Unveiling Biochar Research: Trends, Influential Authors, and Ethical Dilemmas in Hyperprolific Publishing

Akira J Abduh[1]

[1]Affiliation not available

May 17, 2023

## Abstract

This article presents a comprehensive review of the publication trends and influential authors in biochar research based on an analysis of articles published between 2008 and April 2023 in the Web of Science database. The study reveals a significant increase in the number of publications on biochar over the years, reflecting a growing interest in this field. The analysis of highly cited papers reveals the presence of tight clusters of authors, with notable leaders from Korea and China. These individuals demonstrate strong connections within their research networks. The article further identifies the most prolific authors in biochar research, highlighting their significant number of papers and citations. However, the article raises concerns about these hyperprolific authors who publish an unusually high number of papers and authors with excessively high citation counts. Such practices raise questions about feasibility, quality, and ethical conduct in research. Further investigation is necessary to understand the mechanisms behind hyperprolific authorship and ensure the maintenance of rigorous scientific inquiry and ethical standards. The article demonstrates the hyperbole in biochar research publications that may include citation manipulation and boosting. It pointed to worrisome practices by some hyperprolific authors in pursue of high citations. Finally, it emphasizes the importance of balancing productivity with the integrity and rigor of research to uphold the principles of quality and responsible scientific practice.

## Introduction

Biochar is a popular topic in the realm of environmental science and sustainable agriculture, with a growing body of scientific publications dedicated to its study. Biochar refers to the carbon-rich material that is produced through the process of pyrolysis, the controlled decomposition of organic matter in the absence of oxygen (Qian et al. 2015). This highly porous substance has gained significant attention due to its potential benefits in enhancing soil health, sequestering carbon, pollutant removal, and mitigating climate change. Over the years, numerous scientific publications have delved into various aspects of biochar, including its production methods, characterization, applications, and the ecological and agronomic impacts it can have. These publications have highlighted its potential role in sustainable land management practices, offering valuable insights to researchers, practitioners, and policymakers (Allohverdi et al. 2015).

Biochar has been hailed as a potential game-changer in our efforts to combat climate change, improve soil health, and even address energy needs. Its appeal lies in its multifaceted benefits and applications which have led to considerable hype in both scientific and popular discourse (Kumar et al. 2023).

The excitement surrounding biochar is primarily driven by its potential to mitigate climate change. Biochar is essentially a form of charcoal created by pyrolysis, which stabilizes the carbon in the material, turning

it into a form that is not easily decomposed. Consequently, biochar can sequester carbon in the soil for hundreds or even thousands of years, keeping it out of the atmosphere where it would contribute to global warming (Lehmann et al. 2006).

Another aspect of the hype is biochar's promise in the field of agriculture. It has been touted as a panacea for degraded soils, with the ability to improve soil fertility, increase agricultural productivity, and enhance resilience to climate change. Biochar can increase soil water-holding capacity, retain nutrients for plant use, and stimulate beneficial soil microbial activity, which collectively enhance soil health and crop yields (Jha et al. 2010).

Biochar's potential role in waste management and as a renewable energy source has also led to considerable excitement. The process of creating biochar can help manage organic waste, turning a problem into a solution. Moreover, the heat generated during the pyrolysis process can be harnessed and used as a renewable energy source, adding to the green appeal of biochar (Liu et al. 2019).

Despite the hype, it's important to note that while the potential benefits of biochar are impressive, they are not guaranteed (Baveye 2021). The effects of biochar can vary widely depending on a host of factors, including the type of feedstock used to create it, the temperature at which it's produced, how it's applied, and the specific characteristics of the soil it's added to.

The burgeoning hype surrounding biochar has not only caught the attention of the public and policymakers, but has also sparked significant interest within the scientific community. This interest has led to a surge in the publication of research papers exploring various aspects of biochar (Baveye 2021). However, this proliferation of research also underscores the complexity of biochar science, as the results often reveal a nuanced picture of biochar's effects that can depend heavily on specific conditions and applications. Professor Baveye from Paris University called "hyperbole" in discussions around biochar to highlight the exaggerated claims made about its potential benefits (Baveye 2021). These claims are overblown or not sufficiently supported by empirical evidence. While it is true that biochar has shown promise in various applications, the variability in its effects due to factors such as feedstock type, production conditions, and soil characteristics means that it may not always deliver the expected benefits. Moreover, the long-term impacts of biochar application on soil and environmental health are not fully understood, leading to further caution (Baveye 2023). Scepticism or caution is called on the tendency to make broad, generalized claims about its benefits.

Recent years have also seen a significant increase in the publication of highly cited scientific papers on biochar, which are often considered indicative of their impact and quality in the academic community. Identification of such influential papers can be achieved through databases tracking citation data, or via lists compiled by institutions like Clarivate Analytics.

In a recent analysis of characteristics of highly cited papers in Environmental sciences by the author, the study reveals that a small group of exceptionally prolific authors, who publish between 60 to 100 papers annually, dominate the list of highly cited works (Abduh 2023). The majority of these authors work independently, with notable exceptions being two clusters publishing biochar in Korea and China. Network analysis exposes a collective of scientists with an impressive number of highly cited papers, indicating collaboration in publication and citation.

The aim of this study is to analyze and understand the landscape of highly cited researchers and authors in the field of biochar. We seek to identify the most prolific contributors, understand their publishing patterns, and examine the nature and extent of their collaborations. By providing insights into the key influencers shaping biochar research, this study aims to illuminate the current state of this rapidly evolving field, and inform future research directions.

# Methods

This study investigated publication pattern and highly cited papers focusing on biochar, published between 2008 and April 2023. To achieve this, the Web of Science database, a comprehensive source of academic and scientific literature developed by Clarivate Analytics, was utilized. The database was queried for all papers published under the topic "biochar" during the specified period.

The Web of Science database is a trusted tool for research and citation analysis within the scientific and academic communities, as it allows users to track the impact of research, identify trends in academic publishing, and access literature across a wide range of disciplines.

Data from the search results were downloaded and exported to MS Excel for preliminary analysis. Subsequently, VOSviewer 1.6.9, a software tool developed by Nees Jan van Eck and Ludo Waltman at Leiden University Centre for Science and Technology Studies (CWTS), was used to analyze and visualize authors' networks.

VOSviewer specializes in analyzing bibliometric data, such as citation and co-citation data, and can generate a variety of visualizations, including co-citation maps, term maps, and network diagrams. These visualizations enable researchers to understand the relationships among different research topics, authors, and institutions, and identify patterns and trends in scientific literature. VOSviewer is a widely recognized tool in the scientific and academic communities for bibliometric analysis (Qin et al. 2022).

# Results and Discussion

## Publication trend

This study conducted an extensive review of articles published in international English scientific journals on the topic "biochar" listed in the Web of Science database between 2008 and April 2023. The results of the search produce 29,608 papers equating to an average of over 2,700 papers published annually in the past ten years. Out of these, the top 1% or 1,029 papers were identified as highly cited papers by Web of Science. These highly cited papers are distinguished by receiving a significant number of citations relative to other papers published in the same field and year, placing them in the top 1% based on citation count.

To further analyze these 1,029 highly cited papers, a text keyword network was constructed using VosViewer. This network provided insights into the prevalent topics discussed within this influential body of literature (Figure 1).

Figure 1 indicates the research in biochar can be grouped in 3 categories: the use of biochar for adsorption or removals of pollutants, the second is on biochar application to soil for plant growth and yield, and the third is on the degradation of biochar. A smaller group of topic indicates the subject on methods of digestion.

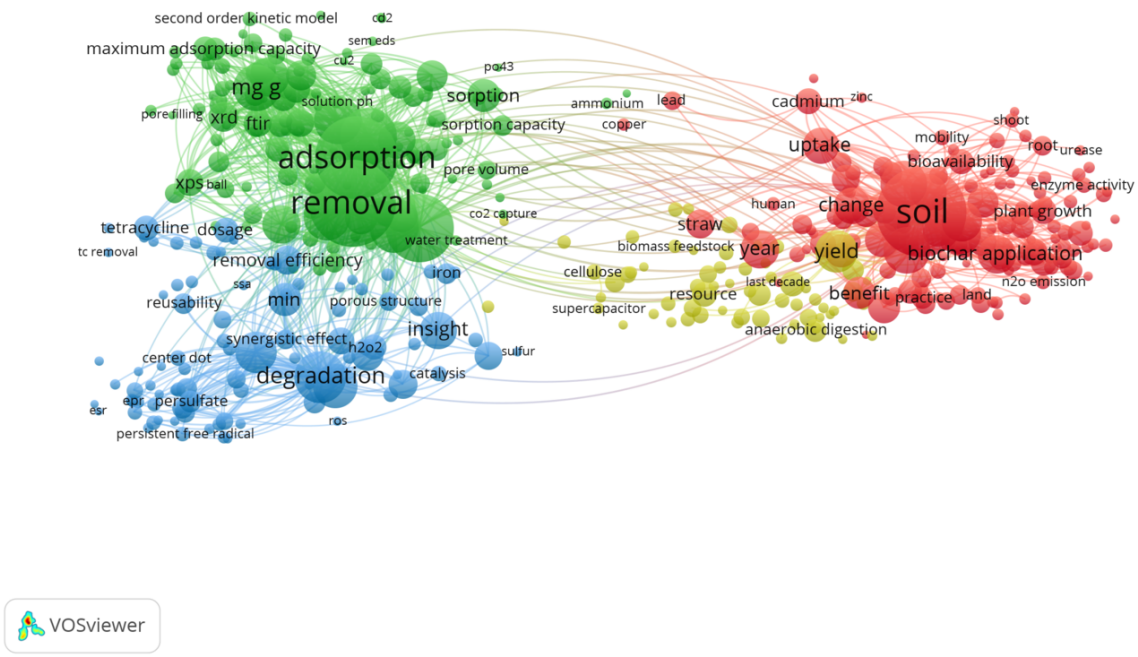


Figure 1: Keywords of highly cited papers on biochar,

## Number of papers

The publication data on biochar shows a clear and steady upward trend from 2008 to 2023. This demonstrates a growing interest in biochar research over the years. In 2008, there were only 12 publications, a number which has increased exponentially over time. The number of publications breached triple digits in 2010 and by 2013, nearly 500 articles were published on biochar. This momentum continued into the mid-2010s, with publications more than doubling from 2015 to 2016.

However, the most significant increase in biochar publications came in the last few years. From 4,296 publications in 2020, there was a significant jump to 5,591 in 2021 and a peak of 6,011 in 2022. While the data for 2023 only covers part of the year, it already shows 1,994 publications, suggesting a continued strong interest in biochar research. The increasing volume of research also suggests that the scientific community is actively exploring the complexities of biochar in a bid to optimize its use and benefits. This result is in line with most bibliometric studies on biochar publications (Abdeljaoued et al., 2020).

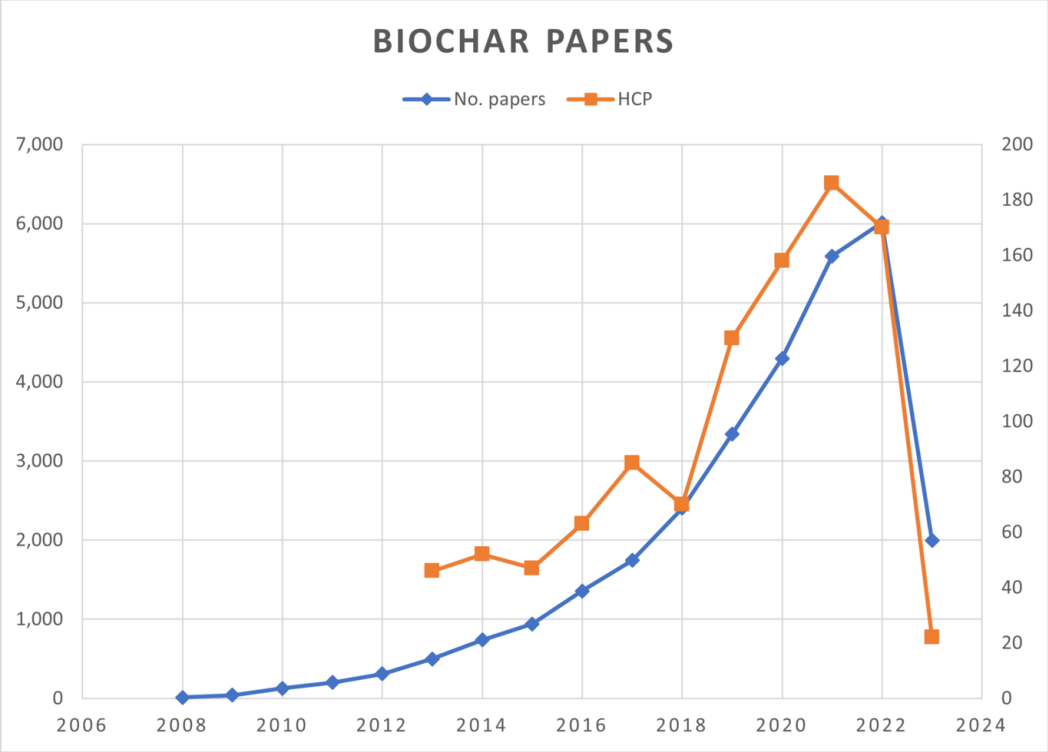


Figure 2: Total number of papers and highly cited papers (HCP) on biochar based on Web of Science from 2008 until April 2023.

Figure 2 also reveals the number of highly cited papers on biochar from 2013 to 2023, which mirrors the overall increase in biochar publications during this period. The increase in highly cited papers signifies that the research is not only growing in volume but also collect citations.

In 2013, among 499 publications, there were 46 highly cited papers. This number rose steadily in the following years, reaching a peak of 186 highly cited papers out of 5,591 total publications in 2021. Even though the total number of publications increased in 2022, the count of highly cited papers slightly dropped to 170, which could be due to the papers not having enough time to accumulate citations.

The data for 2023 only represents part of the year, but with 22 highly cited papers out of 1,994 total publications so far, the year is on track to continue the trend of growing influence in biochar research.

The increase in these highly cited papers over time suggests that biochar research is still gaining momentum to the broader field of environmental science, continuing the trend from previous bibliometric studies (Qin et al. 2022).

## Prolific authors

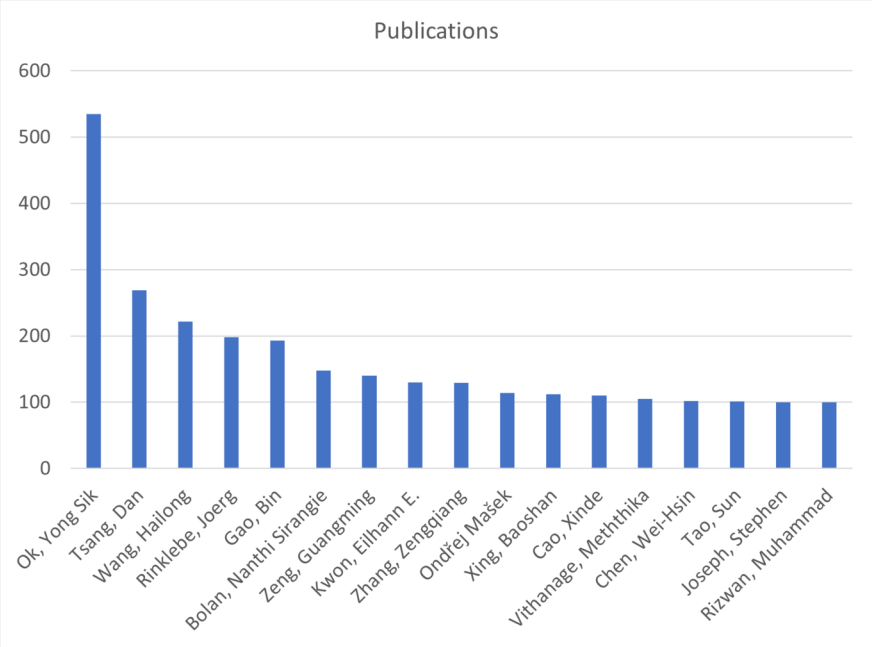


Figure 3: Profilic authors who have published more than 100 papers on biochar based on Web of Science

Table 1. Profilic authors who have published more than 100 papers on biochar based on Web of Science from 2008 until Match 2023.

| **Name** | **Count of papers** |
|---|---|
| Ok, Yong Sik | 535 |
| Tsang, Dan | 269 |
| Wang, Hailong | 222 |
| Rinklebe, Joerg | 198 |
| Gao, Bin | 193 |
| Bolan, Nanthi Sirangie | 148 |
| Zeng, Guangming | 140 |
| Kwon, Eilhann E. | 130 |
| Zhang, Zengqiang | 129 |
| Ondřej Mašek | 114 |
| Xing, Baoshan | 112 |
| Cao, Xinde | 110 |
| Vithanage, Meththika | 105 |
| Chen, Wei-Hsin | 102 |
| Tao, Sun | 101 |
| Joseph, Stephen | 100 |
| Rizwan, Muhammad | 100 |

The list in Table 2 and Figure 3 provides a snapshot of the most prolific authors in the field of biochar research. Each of these researchers has made significant publications, as demonstrated by the large number of papers they've published on the subject. At the top of the list is Yong Sik Ok from Korea University, who has an impressive count of 535 publications. Following Ok is Dan Tsang from Hongkong Polytechnic University with 269 publications, and Hailong Wang from Foshan University with 222 papers.

The remaining authors, including Joerg Rinklebe from Wuppertal in Germany, Bin Gao from University of Florida, Nanthi Sirangie Bolan from University in Western Australia, and others, have each published over 100 papers, underlining their active roles in publishing biochar research.

The results are in line with previous bibliometric studies who hailed Yong Sik Ok as the most prolific researcher in Biochar followed by Gao Bin and Dan Tsang (Abdeljaoued et al. 2020; Li et al. 2020). Qin et al. (2022) already revealed closely collaborating clusters of authors with strong subgroup connections, with Yong Sik Ok, Daniel C.W. Tsang and Bin Gao at their core. It's worth noting that the presence of these authors with high publication counts indicates a concentrated effort by a group of collaborating researchers in this field.

## Highly cited authors

Table 2 lists profilic authors who have published more than 10 highly cited papers on biochar. Highly cited papers are scientific papers that have received a large number of citations from other papers in the scientific literature or top 1% based on the number of citations received when compared to other papers published in the same field in the same year. They are from the last 10 years of publications (from 2013 to April 2023).

Table 2. Profilic authors who have published more than 10 highly cited papers (HCP) on biochar based on Web of Science.

| **Author** | **Affiliation** | **HCP** | **Group** |
|---|---|---|---|
| Ok, Yong Sik | Korea University, Korea | 92 | Ok |
| Tsang, Dan | Hongkong Polytechnic, China | 66 | Tsang |
| Gao, Bin | University of Florida, USA | 46 | Gao |
| Rinklebe, Joerg | Wuppertal University, Germany | 46 | Ok |
| Zeng, Guangming | Hunan University, china | 46 | Zeng |
| Bolan, Nanthi Sirangie | University of Western Australia, Australia | 31 | Ok |
| Wang, Hailong | Foshan University, China | 28 | Ok |
| Tan, Xiaofei | Hunan University, china | 19 | Zeng |
| Shaheen, Sabry M. | Kafrelsheikh University, Egypt | 19 | Ok |
| Zhang, Chen | Hunan University, china | 17 | Zeng |
| Cao, Xinde | Shanghai Jiao Tong University | 16 | Ok, Gap |
| Huang, Danlian | Hunan University, china | 16 | Ok |
| Zhang, Zengqiang | Northwest A&F University - China | 14 | Ok |
| Hou, Deyi | Tsinghua University | 14 | Ok |
| Tao, sun | Korea University, Korea | 14 | Ok |
| Lai, Cui | Hunan University, china | 13 | Zeng |
| Cheng, min | Hunan University, china | 13 | Zeng |
| Zimmerman, Andrew R. | University of Florida, USA | 13 | Gao |
| Sun, Yuqing | Sun Yat Sen University | 13 | Tsang |
| Lam, Su Shiung | Universiti Malaysia Terengganu, Malaysia | 12 | Ok |
| Ali, Shafaqat | China Medical University (Taiwan) | 12 | Ok |
| Vithanage, Meththika | University Sri Jayewardenepura, Si Lanka | 12 | Ok |

| | | | |
|---|---|---|---|
| Rizwan, Muhammad | Government College University Faisalabad | 12 | Ok |
| Wang, Shengsen | Yangzhou University | 11 | Gao, Ok |
| Ye, Shujing | Guangxi University | 11 | Zeng |
| Sarkar, Binoy | University of South Australia | 11 | Ok |

Yong Sik Ok tops the list with a remarkable 92 highly cited papers, further solidifying his position as a leading figure in biochar publication. Following Ok, Dan Tsang with 66 highly cited papers and Bin Gao, Joerg Rinklebe, and Guangming Zeng, each with 46 highly cited papers, have also made substantial contributions to the field that have resonated with their peers.

Even authors toward the bottom of the list from the third world countries, such as Su Shiung Lam from Malaysia, Shafaqat Ali from China, Meththika Vithanage from Sri Lanka, and Muhammad Rizwan from Pakistan, each with 12 highly cited papers, have made to the citations list. The high citation counts indicate that these authors' work is not only prolific but also of highly cited by others. Johannes Lehmann, the biochar expert from Cornell, hailed as a top scientist was dethroned by Yong Sik Ok in terms of highly cited paper (Kumar et al. 2023).

Additionally, this study conducts a network analysis of co-authorship among the authors of highly cited papers. The findings using VOSviewer, presented in Figure 4 using VosViewer analysis, indicate that with there were 4 main groups of researchers dominating the highly cited papers. They are:

(1) Red group led by Yong Sik Ok from Korea University

(2) Purple group led by Dan Tsang from Hongkong Polytechnic

(3) Yellow group led by Gao Bin from Florida University

(4) Green group led by Guangming Zeng from Hunan University

A small Blue group led by Yauyu Zhou from Hunan Agricultural University is actually in the Green group.

Among them, the Yong Sik Ok and Dan Tsang had the closest relationship as diplayed in Figure 5. The close-up reveals the complex network of authors displayed in Table 2 with group members include Hailong Wang from Foshan University, Deyi Hou from Tsinghua, Sarkar Binoy from South Australia, Jorg Rinklebe from Wuppertal, Sabry Shaheen from Kafrelsheikh, Egypt. Other authors in this Yong Sik Ok group include: Amit Bahanatgar, Scott X Chang, Pavani Dissanayake, Ali El-Naggar, Muhammad Farooq, Avanthi Igalavithana, Kim Ki-Hyun, Dinish Moghan, Nabeel Khan Niazi, Patryk Oleszczuk, etc.

Qin et al. (2022) previously had exposed interconnected groups of authors who closely collaborate, with a central core consisting of Yong Sik Ok, Daniel C.W. Tsang, and Bin Gao, who maintain strong connections within a subgroup. This suggests that the majority of authors of highly cited papers are interconnected. All authors within this cluster have contributed more than 10 highly cited papers (See also group membership in Table 2).

The group that had some co-authorship with Ok and Tsang is the group led by Bin Gao from Florida. The group led by Guangming Zeng had less relationship with Ok. While some researchers Johanness Lehmann and Stephen Joseph have some co-authorships with Yong Sik Ok.

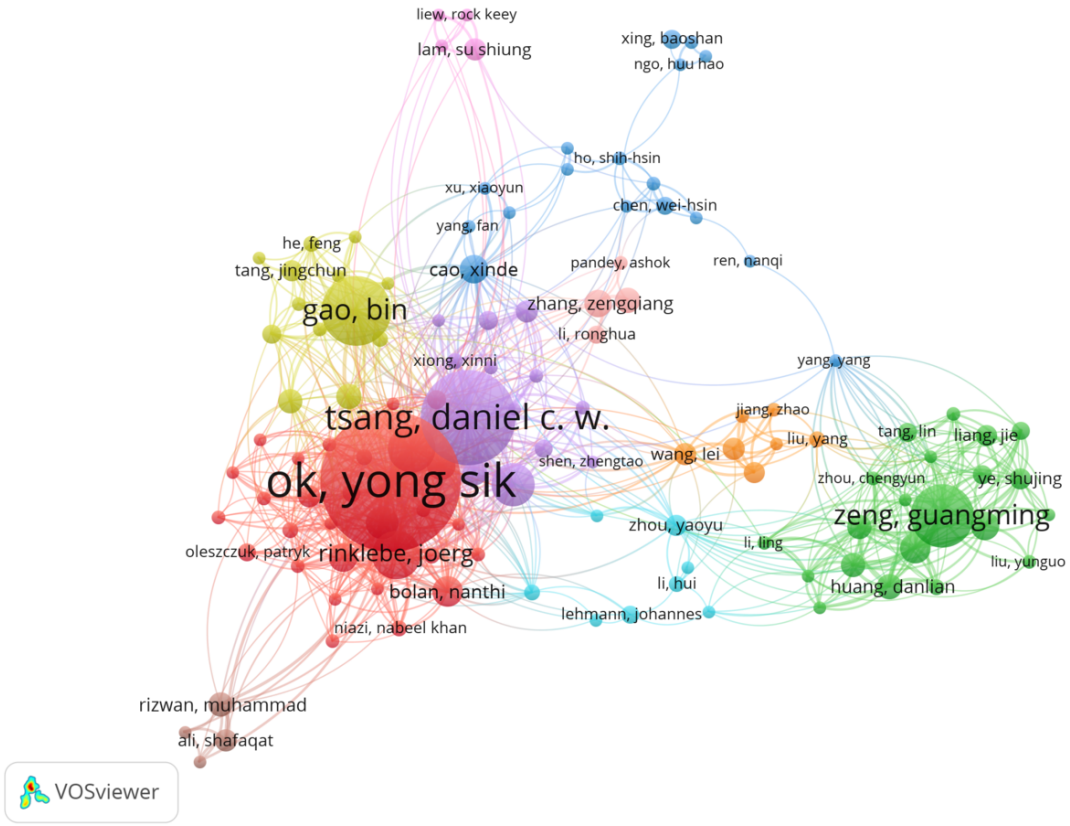


Figure 4: This is co-authorship network of highly cited papers in biochar.

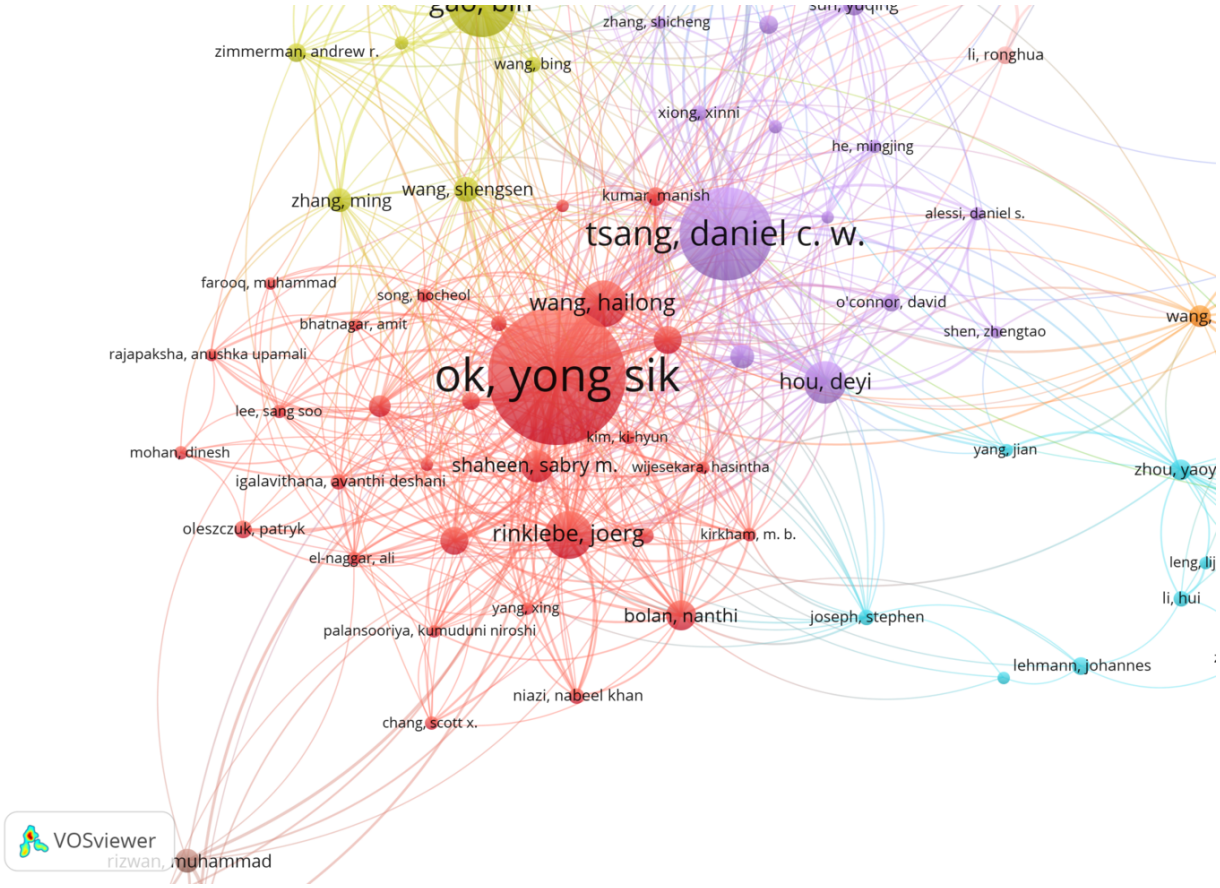


Figure 5: This is a close up of Fig 4 showing the two centre networks

This network of tight co-authorship is further revealed in a network analysis based on the University affiliation (Figure 6). Korea University (Yong Sik Ok) and Hongkong Polytechnic (Dan Tsang) drive the group of authors in producing these highly cited papers. In particular Korea and Hong Kong Poltechnic becomes the center of papers mass producer. They supplied to King Abdullah Azizm Sejong University, Tsinghua University etc. University of Florida also has its own cluster.

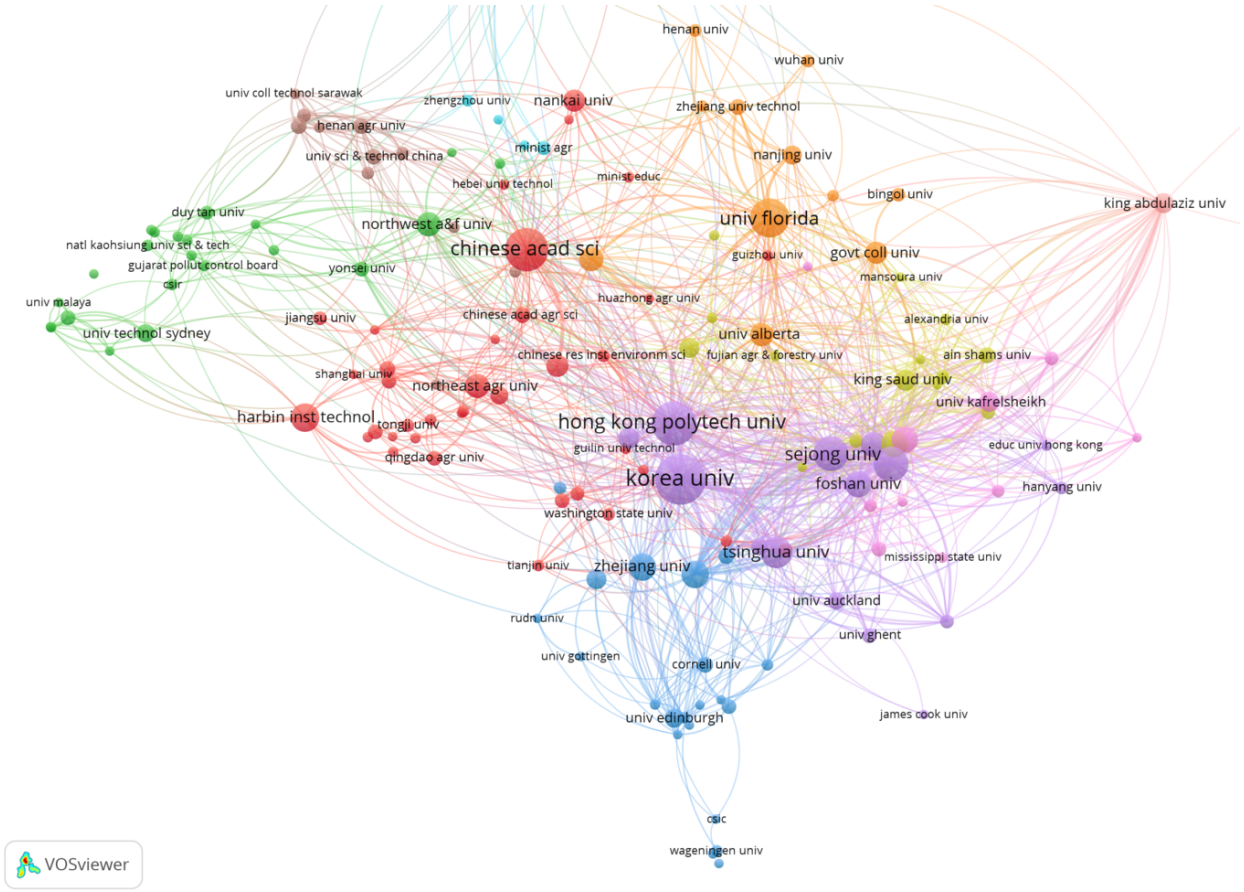


Figure 6: This is a co-authorship network of highly cited papers in biochar based on affiliated universities.

Figure 7 illustrates the authors of references cited in highly cited papers (HCP) related to biochar. Once again, the figure demonstrates the presence of closely interconnected authors who frequently cite each other in these highly cited papers. Figure 8 provides a close up of the citation pattern, once again prominent complex relationship, with Yong Sik Ok and Dan Tsang being dominant in their citations. They are closely linked to Hailong Wang, Ali El Naggar, Deyi Hou, Shaheen Sabry, and Binoy Sarkar, Jorg Rinklebe, Scott X. Chang, as evidenced by the interconnecting lines in the figure.

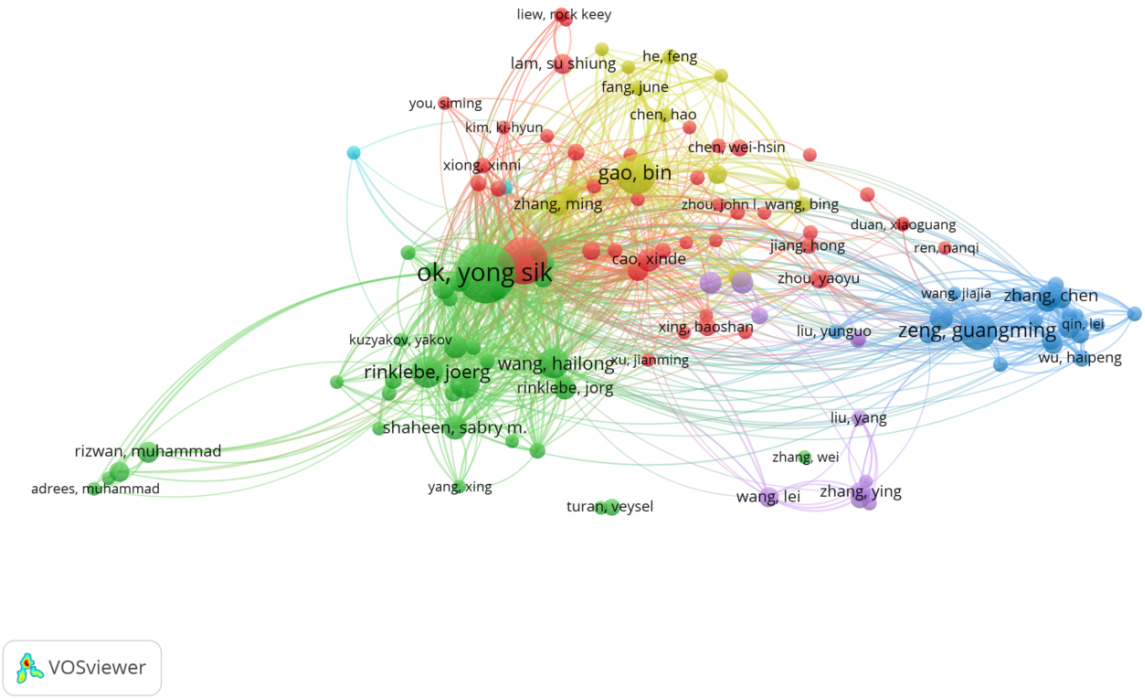


Figure 7: This is authors of references cited by highly cited papers (HCP) in biochar

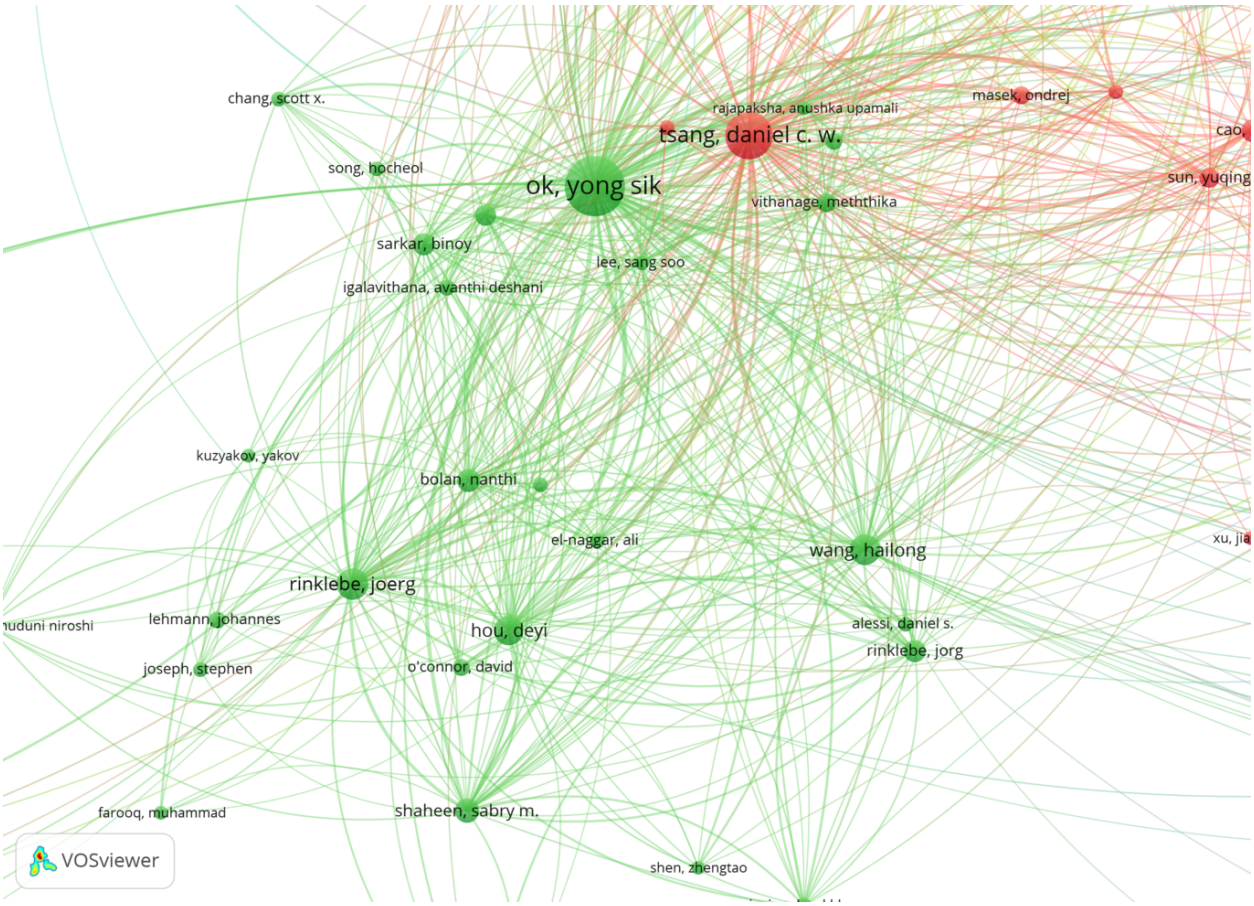


Figure 8: This is a close up of Fig 7.

## Hyperprolific and hypercited authors

Table 3 shows the number of highly cited papers (HCP) on biochar for specific authors, as well as their total number of HCP.

Yong Sik Ok has contributed to 92 HCP on biochar out of a total of 114 HCP, indicating a significant presence in the field. Similarly, Dan Tsang has authored 66 HCP on biochar out of a total of 90 HCP, further highlighting their significant contributions.

Bin Gao has contributed to 46 HCP on biochar out of a total of 56 HCP, indicating a focused research interest in this area. Joerg Rinklebe has also contributed to 46 HCP on biochar, with a total of 63 HCP, suggesting a strong presence in the field. Notably, Guangming Zeng has a substantial contribution of 46 HCP on biochar, but an exceptionally high total of 199 HCP, which suggests a wide range of research interests beyond biochar. Johannes Lehmann from Cornell University was previously identified as having the largest citation in biochar is now dethroned by Yong Sik Ok and Dan Tsang.

The numbers of highly cited papers (HCP) by some authors in the field of biochar appear to be unusually high and potentially unrealistic. For example, Yong Sik Ok, who published copiously has on average 11

highly cited papers per year.

Table 3. Hyperprofilic authors who have published more than 40 highly cited papers (HCP) on biochar, their HCP on biochar and total HCP, based on Web of Science.

| Authors | HCP on biochar | Total HCP |
|---|---|---|
| Ok, Yong Sik | 92 | 114 |
| Tsang, Dan | 66 | 90 |
| Gao, Bin | 46 | 56 |
| Rinklebe, Joerg | 46 | 63 |
| Zeng, Guangming | 46 | 199 |

Table 4. Number of papers published by selected hyperprofilic authors from 2012 to 2022 based on Web of Science.

| Year | **Ok, Yong Sik** | **Tsang, Dan** | **Gao, Bin** | **Rinklebe, Joerg** | **Zeng, Guangn** |
|---|---|---|---|---|---|
| | Korea University | Hongkong Polytech University | University of Florida | Wuppertal University | Hunan Universit |
| 2022 | 59 | 39 | 37 | 88 | 39 |
| 2021 | 101 | 89 | 32 | 97 | 57 |
| 2020 | 106 | 145 | 47 | 49 | 63 |
| 2019 | 120 | 104 | 56 | 57 | 167 |
| 2018 | 96 | 99 | 40 | 34 | 225 |
| 2017 | 113 | 50 | 25 | 44 | 170 |
| 2016 | 62 | 12 | 35 | 8 | 144 |
| 2015 | 27 | 7 | 21 | 11 | 140 |
| 2014 | 24 | 6 | 23 | 10 | 69 |
| 2013 | 24 | 10 | 22 | 5 | 44 |
| 2012 | 14 | 0 | 17 | 1 | 42 |

The data in Table 4 showcases an exceptional level of productivity by the listed authors in the field of biochar research over the past decade. Such high publication counts raise questions regarding the feasibility of such output and may provoke discussions about the nature of hyperprolific authorship.

Yong Sik Ok, for instance, has consistently published more than 60 papers annually since 2016, peaking at 120 in 2019 (1 paper per 3 day). Similarly, Dan Tsang has had a significant output, with an annual production of 100 papers per year, reaching a high of 145 publications in 2020 (1 paper per 2.5 day). Guangming Zeng's publication counts are even more extraordinary, with an astounding 225 papers in 2018 (3 papers every 2 day).

Dan Tsang and Jorg Rinklebe are unique cases of rags to riches in scientific publication. Dan Tsang had zero paper in 2012, and 12 papers in 2016 but rose exponentially to publish 145 papers in 8 years (2020). Similarly for Rinklebe, Web of Science recorded only 1 paper in 2012 and 8 papers in 2016 but was boosted to mill 97 papers in 2021. Yong Sik Ok who had 14 papers in 2012 boosted to publish 113 papers in just five

years. The cases of Yong Sik Ok, Dan Tsang and Jorg Rinklebe, as described, indeed indicate a significant rise in the number of publications within a relatively short period of time. While these cases may appear remarkable, it's generally impossible or unfeasible.

While these authors' contributions to the field are impressive, such high publication rates may seem implausible for any academic, given the time and effort typically associated with conducting research, writing, and the publication process.

It's worth noting that high publication counts could potentially be influenced by various factors such as co-authorship, where multiple authors contribute to a single paper, or the involvement of these researchers in large-scale, collaborative projects that yield multiple publications. The nature of the research, such as data-driven or review-based studies, might also influence the publication rate.

However, the feasibility of such high productivity levels may warrant further investigation into the mechanisms that allow for hyper-prolific authorship and whether such patterns uphold the principles of quality and ethical conduct in research. The pressure to publish mustn't compromise the rigor and integrity of the scientific inquiry.

Table 5. Number of highly cited papers published by selected hyperprofilic authors from based on Web of Science.

| Year | Ok, Yong Sik | Tsang, Dan | Rinklebe, Joerg |
|---|---|---|---|
| 2023 | 1 | | |
| 2022 | 10 | 6 | 14 |
| 2021 | 17 | 18 | 14 |
| 2020 | 23 | 25 | 12 |
| 2019 | 26 | 20 | 10 |
| 2018 | 10 | 12 | 4 |
| 2017 | 17 | 8 | 7 |
| 2016 | 6 | 1 | 1 |
| 2015 | 2 | | |
| 2014 | 3 | | |

The incredible productivity and ability to produce 3 paper per week would usually indicate rush or low quality papers. However, this is not the case for Yong Sik Ok and Dan Tsang, who managed to gain highly cited papers so easily (Table 5).

Analyzing the data, we can observe that the number of highly cited papers for these authors that appear to be unrealistically high. For example, Yong Sik Ok was recorded to publish 59 papers in 2022, and 10 of the papers are listed as highly cited papers. Similarly in 2019, Ok published 120 papers and 26 papers are highly cited. The ability to publish copiously and easily being highly cited rapidly beg the question of how and why?

While previous bibliometric studies (e.g. Abdeljaoued et al. 2020; Kumar et al. 2023; Qin et al. 2022) highlight the value of publication data and the potential for data-driven analysis in biochar research, they overlook the ethical concerns associated with hyperprolific publishing and citation boosting. Addressing these ethical considerations is essential for upholding the integrity and reliability of scientific literature.

Hyperprolific publishing may also prioritize quantity over rigorous peer review, compromising the integrity and reliability of scientific literature. Citation boosting, on the other hand, involves artificially inflating the

number of citations to a particular article or author through manipulative practices, such as self-citation, citation rings, or coercive citation requests. For example, some of these authors are well-known editors in some journals. Dan Tsang in Web of Science was recorded to review 20–30 papers per month. This means Dan Tsang publishes a paper every 2.5 days and also review 1 paper per day (including weekends and public holidays).

The reward for highly citation including high h-index, being listed as highly cited researchers by Clarivate. Highly cited research is seen as influential and impactful in the academic community. High citation counts can positively impact researchers' career prospects. It can help in securing grants, promotions, and tenure. Achieving high citation counts can enhance a researcher's reputation and contribute to their overall prestige within the academic community. It can lead to invitations to serve on editorial boards, conference committees, and prestigious academic societies.

It is important to remember that some would pursue unethical means to gain high citations. This negative behavior distorts the true impact and influence of research and undermines the integrity of citation-based metrics, such as the h-index or journal impact factor.

# Conclusions

In conclusion, biochar as hyperbole publication in soil research is examined and worrisome practices are critically reviewed. The article raises concerns regarding the feasibility and ethical implications of hyperprolific authors in biochar who publish an exceptionally high number of papers and authors who accumulate an unusually high number of citations. While their productivity may initially seem impressive, it begs the question of whether such output is realistic and whether it compromises the quality and integrity of the research. The analysis of highly cited papers reveals the presence of closely collaborating groups of authors, with notable ring leaders such as Yong Sik Ok, Daniel C.W. Tsang, and Bin Gao. These individuals demonstrate strong connections within their respective publication and citation networks.

The article also highlights cases of hyper prolific authors (Ok, Tsang, Gao, Zeng, Rinklebe) who have published an exceptionally high number of papers per year, sometimes averaging several papers per week. Such rates raise doubts about the thoroughness and rigor of the research process. It is unlikely that a researcher or a group of researchers can conduct extensive and rigorous studies within such short timeframes, leading to concerns about rushing or sacrificing quality for quantity.

Moreover, the article examines the same group authors who have accumulated an unusually high number of citations. While a high citation count can be an indicator of the impact of their research, it also raises questions about the reliability and accuracy of the citations. In addition, the potential for self-citation, citation manipulation, or inflated citation counts due to collaboration networks needs to be considered.

The feasibility and ethics of hyperprolific authorship and exceptionally high citation counts must be critically examined to ensure that the scientific community upholds principles of quality, integrity, and responsible research. While factors such as co-authorship and involvement in collaborative projects may contribute to high publication rates, assessing whether these rates are achievable without compromising the scientific process is important. It is also important to ethically define what constitutes authorship. Further investigations and discussions are warranted to understand the mechanisms that enable hyperprolific authorship and the implications for the scientific community.

Hyperprolific publishing raises ethical concerns and dilemmas:

1. Quality vs. Quantity: Hyperprolific publishing can put pressure on researchers to prioritize quantity over quality. This may lead to rushed or superficial research, compromising the rigor and validity of the findings. Ethical concerns arise when researchers prioritize quantity at the expense of maintaining high standards of scientific integrity.

2. Authorship: Determining authorship and contributions becomes challenging in hyperprolific publishing. It may lead to dilemmas related to properly acknowledging and attributing the contributions of individuals involved in the research. Unethical practices such as honorary authorship or excluding deserving contributors can arise when there is an excessive focus on publishing as many papers as possible.

3. Research Misconduct: Hyperprolific publishing can increase the risk of research misconduct. With the pressure to produce a large volume of research, researchers may be tempted to engage in practices such as data fabrication, plagiarism, or salami slicing (splitting a single study into multiple publications).

4. Reviewer and Editor Fatigue: Hyperprolific publishing can strain the peer review system. Reviewers and editors may face increased workloads, leading to fatigue and potentially compromising the quality and thoroughness of the peer review process. This can hinder the ability to identify flaws, ensure ethical conduct, and maintain high publication standards.

5. Resource Allocation: Hyperprolific publishing can result in an uneven distribution of research resources. Researchers who engage in hyperprolific publishing may receive disproportionate funding, recognition, and career advancement opportunities compared to others who focus on producing fewer but higher-quality publications. This imbalance can create ethical concerns related to fairness and equity in resource allocation.

6. Reproducibility and Transparency: Hyperprolific publishing can hinder reproducibility and transparency efforts. With a large volume of publications, it may be challenging for researchers to provide the necessary data, code, or materials to allow others to replicate or build upon their work. Lack of reproducibility and transparency can impede scientific progress and erode public trust in research.

7. Overlooking Negative Results: Hyperprolific publishing may incentivize researchers to focus on publishing positive or significant results, while neglecting negative or inconclusive findings.

Addressing these ethical dilemmas requires promoting responsible research practices, emphasizing quality over quantity, fostering a culture of integrity, and ensuring adequate support and resources for researchers. Institutions, funding agencies, and the research community as a whole play a crucial role in establishing guidelines and promoting ethical conduct in hyperprolific publishing.

## Acknowledgement

The author thanks Prof. Phillippe Baveye from Paris University for suggesting the topic of Biochar and encouragement to pursue the research on this topic.

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