Study of the feasibility of SAF production in Brazil

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ABSTRACT

The use of sustainable aviation fuels, better known as SAF, is essential for Brazil to advance in the decarbonization of the aviation sector and meet the goal established by the International Civil Aviation Organization (ICAO): zero carbon emissions in international aviation by 2050. The use of SAF represents less than 0.5% of the fuel volume used by air transport. Brazil has the potential to lead this new market globally, due to the availability of raw materials, technologies and extensive experience in the production of biofuels. The matter is being discussed in the Brazilian National Congress through the Fuel of the Future Bill (PL 528/2020). One of the proposals is that air operators will be required to reduce greenhouse gas emissions on domestic flights using SAF.

Keywords: Aviation; Decarbonization; SAF.

INTRODUCTION

In the Fischer-Tropsch (FT) route, the material is collected and sent to the industrial plant, where it is gasified to synthesis gas. After the cleaning process, the synthesis goes to the Fischer-Tropsch reactor, where it is converted by catalysis into liquid hydrocarbons, which are fractionated into SAF and liquid fuels. Surplus energy can be obtained as a co-product of the process. To the FT plants are, in general, self-sufficient and do not depend on large quantity of inputs such as hydrogen, making it convenient for them to remain close to the availability of raw materials. Eventually, they could be built close to sugar cane mills to improve logistics [1].

The hydroprocessed esters and fatty acids (HEFA) plant is currently the best-known process for producing SAF and is already has been tested on a large scale. In the process, the oleaginous raw material undergoes hydrotreatment with hydrogen in the presence of a catalyst. Unsaturated carbon bonds are saturated and oxygen is removed. Subsequently, the chains of hydrocarbons undergo hydrocracking in different ranges, are isomerized and fractionated, producing SAF and other products, such as diesel, naphtha and propane [2]. Finally, the SAF is distributed to airports, where it is mixed with kerosene fossil (Jet A).

In SAF production plant via the alcohol to jet (ATJ) route, the waste is sent to a second-rate ethanol plant generation (2G technology), based on enzymatic hydrolysis. Then the ethanol is sent to a plant where the alcohol molecules are dehydrated, oligomerized and finally hydrogenated into chains of hydrocarbons suitable for use as drop-in fuels. To obtain low logistical costs and better use of infrastructure, 2G plants could be conveniently located close to power plants sugar cane. Due to the level of hydrogen consumption of ATJ, it would also be better to place them near oil refineries [3].

MATERIALS AND METHODS

The research was carried out in the Web of Science Database on September 5th, 2024, from the insertion of filters. Publications on SAF feasibility were extracted from the Web of Science (WoS) - Clarivate database. Therefore, the keywords “Sustainable aviation fuel” and “Sugarcane” were inserted in the platform’s search field without filtering the publications by period. The following scientometric indicators were used to collect data: (i) year of publication, (ii) citations, (iii) contributions from countries.

RESULTS AND DISCUSSION

Figure 1 illustrates the growth in publications between 2014 and 2024, totaling 10 publications: 8 articles and 2 review articles. The year 2024 already stands out with 45 citations. Brazil appears in second place as the country that publishes the most in the SAF area researched, behind only the USA.

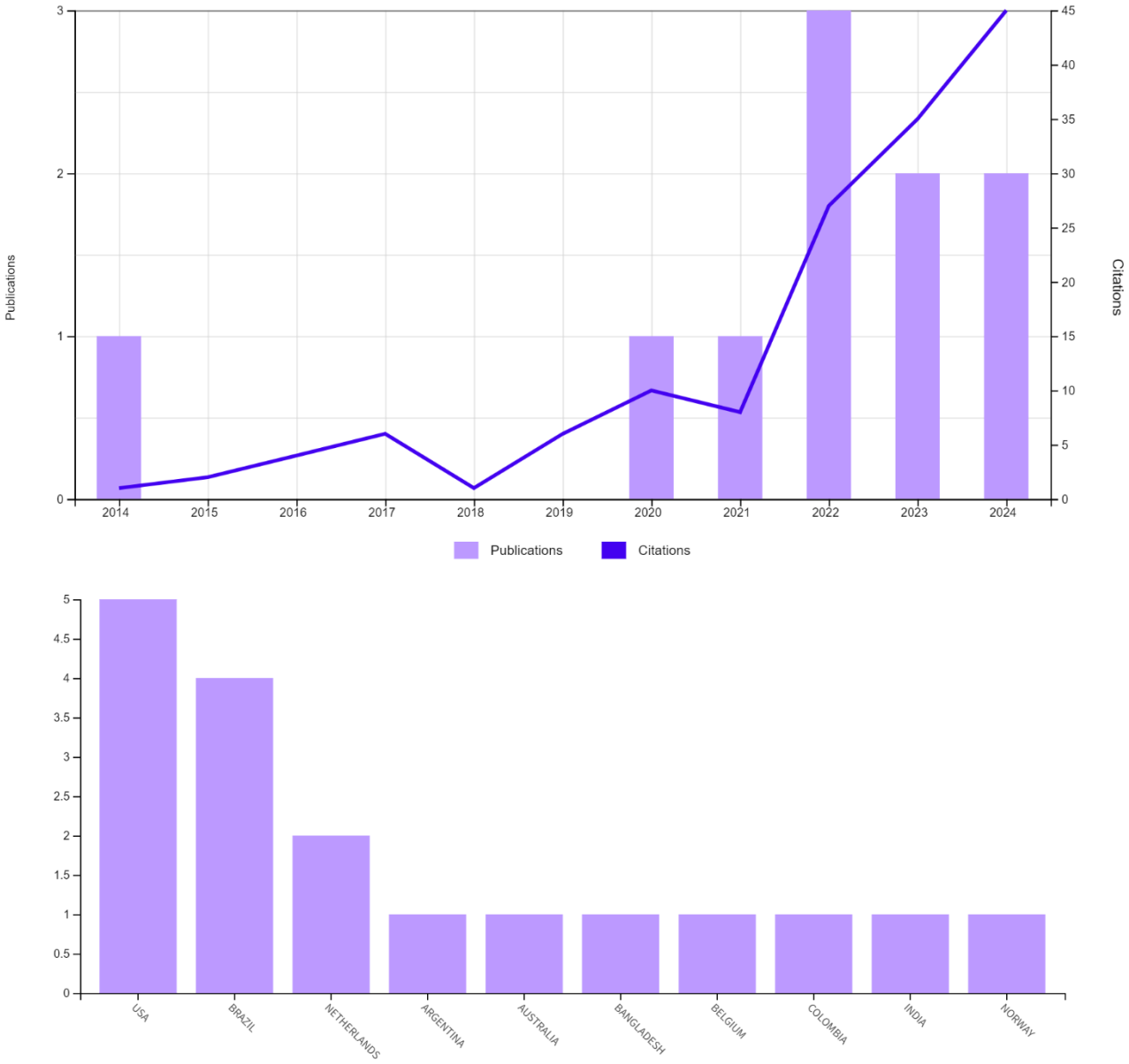

Figure 1. Publications on SAF feasibility.

Source: Web of Science Database (2024)

The global sustainable aviation fuel market is expected to be worth USD 16.8 billion by 2030, growing at a GAGR of 47.7% during the forecast period [4]. SAF is a liquid fuel, like conventional fuels, and can be transported through existing global transport networks. As a result, production facilities can be built in regions with ideal conditions, enabling the cheapest and most efficient production to fulfil the

emerging global demand. Several factors influence how favorable a location is to produce SAF from technical and economic standpoints. The most important aspect is the availability of cheap local green energy (electricity and heat). Next, the feedstock availability and associated costs are key for the right technology choice. Additional factors to consider may include existing feedstock logistic systems, labor costs and relevant local expertise and infrastructure. Considering these factors, 20 key regions were identified globally, which are well positioned to scale local SAF production, and Brazil figures on the Top 20 production location list [5].

The National Biokerosene Program is part of the context of the Fuel of the Future Program, created by the National Energy Policy Council (CNPE) to increase the use of sustainable fuels in the national energy matrix. The Fuel of the Future presents two objectives directly related to the sanctioned bill: introduction of the production of sustainable aviation fuels in the transport matrix; and the creation of incentives for the application of resources in projects focused on the development of the sustainable aviation fuels market.

CONCLUSION

Brazil is one of the countries with the greatest potential for SAF production. Although Brazil is the second largest ethanol producer in the world, losing to the USA which uses the routes of obtaining ethanol by ethylene hydration and by corn fermentation, Brazil is the largest sugarcane producer in the world, whose residue known as bagasse can be used for the production of SAF via two routes: the ATJ route from second generation ethanol produced by the fermentation of sugarcane bagasse, and the FT route, directly from the gasification of sugarcane bagasse. Future Fuel was incorporated into the national strategy for climate neutrality, launched by Brazil at COP-26, in which sustainable aviation fuel will play a fundamental role in the process of reducing emissions in the airline sector.

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