International Symposium on Sustainable Aviation 2016

ISSA 2016

29 May - 1 June 2016, Istanbul, TURKEY

Abstract Book

Editors:

Prof. Dr. T. Hikmet Karakoc

Prof. Dr.Baris Ozerdem

Assoc. Prof. Dr. M. Ziya Sogut

Assoc. Prof. Dr. C. Ozgur Colpan

Assoc. Prof. Dr. Onder Altuntas

Assoc. Prof. Dr. Emin Acikkalp

Dr. M. Zeki Yilmazoglu

ISBN

978-605-89885-6-9

PAPER NO: ISSA - 2016 #96

GREEN INTEGRATED SEWAGE TREATMENT TECHNOLOGY OF AIRPORT

Sergii I Shamanskyi, Sergii V Boichenko
National Aviation University, Ukraine
shamanskiy_s_i@ukr.net
chemmotology@ukr.net

SUMMARY

There is proposed a new environmentally friendly technology of airline enterprises' sanitary sewage water treatment, which allows to improve quality of the treated sewage water, to diminish harmful impacts on environment during sewage sludge utilization and to obtain additional amount of alternative energy sources.

Keywords: airline enterprise, sewage water, sludge utilization, digestion, alternative energy sources.

The main purpose of the proposed new technology is enhancement of environmental safety and economic efficiency of sewage water treatment processes. The next challenges are met here: diminish harmful impacts of treated sewage waters and their sludges on environment, thereby improvement of ecology and life conditions; producing additional alternative energy sources during sewage water treatment and their sludge utilization, thereby enhancement of enterprises' energy independence. The major idea is that within the bounds of the technology it is necessary to: organize an additional treatment of sanitary sewage water, after the water has been treated in conventional treatment facilities, by using it as growth medium for microalgae cultivation and then producing biofuel out of them; organize a process of anaerobic digestion of sanitary sewage water sludges subject to modern scientific concepts, which describe kinetics of the process. The main drawbacks of facilities for microalgae cultivation are: open type bioreactors – vulnerability to weather conditions, substantial losses of CO2 during cultivation, complicacy in providing contiguous cultivation; closed type bioreactors – complicacy in feeding CO2 inside the reactor, limitedness in productivity because of low CO2 solubility in water. The main drawback of anaerobic digestion is that conventional technologies are not perfect.

The processes take rather long time. Facilities are constructed of large capacities with sludge continuance inside of them. Obtained amount of biogas is not very significant. Under real conditions gaining energy from burning all obtained biogas often does not cover power inputs in temperature stabilizing of sludges during digestion. To make microalgae cultivation more effective there is proposed: using CO2, obtained during anaerobic digestion of sludge, conducted according to new technology; conducting cultivating process under excessive pressure for increment of CO2solubility in water; providing possibility to introduce CO2 into the reactor continuously; providing possibility to introduce necessary nutrients for microalgae; providing continuity of cultivating process. There is proposed design of a new facility – continuously working bioreactor, which can provide all proposed improvements in the technology. Expected results of organizing additional water treatment in bioreactors are: decreasing of pollutants' amounts, which are released into environment with sewage waters; obtaining raw materials (microalgae) for producing motor fuel, reducing amount of CO2, which is released into the atmosphere. To make digestion processes more efficient there is proposed technology with division of the process into four consecutive stages: hydrolysis, acetogenesis, acidogenesis, and methanogenesis.

According to the technology each stage takes place in separate isolated capacity. In each capacity there should be created optimal parameters of medium for acting on this stage specific groups of bacteria. Results of researches have shown optimal conditions for each stage. They are different. For hydrolysis there is proposed intensification of organic compounds destruction by using intensified ultrasonic cavitation. For acidogenesis – adding hydrogen for increasing its partial pressure in the reactor. For acetogenesis – immobilization of working bacteria, adding CO2 and increasing pressure in the reactor. For methanogenesis – also bacteria immobilization, adding different microelements and biostimulators. Expected results of new organization of digestion process are: shorten the process of digestion from 15 to 3 days; increasing the output of biogas per one volume unit of sludge; increasing content of methane in the biogas from 60% to 95%; obtaining marketable CO2; obtaining safe organic fertilizer, which does not decay and does not contain pathogenic microorganisms.

REFERENCES

Ziemiński, K., Frąc, M., 2012. Methane fermentation process as anaerobic digestion of biomass: Transformations, stages and microorganisms. African Journal of Biotechnology Vol. 11(18), pp. 4127-4139.

Pavliukh L.I., Boichenko S.V. Application of natural raw plant materials based sorbents in the purification systems of oil contaminated waters of aviation enterprises. 2012. Proceedings the Fifth world congress ["Aviation in the XXI-st century"], Kiev, 25-27 September, Vol.3. – P.4.3.48-4.3.50.

PAPER NO: ISSA - 2016 #99

RESEARCH ANTIKNOCK RATING OF NEW COMPOSITION FOR AVIATION GASOLINE

Olesya Kondakova, Sergii Boichenko
National Aviation University, Ukraine
izabellac@mail.ru
chemmotology@ukr.net

SUMMARY

Traditionally components of aviation gasoline are produced by various technological processes. The basical fractions of aviation gasoline are: gasoline straight distillation of crude oil, catalytic reforming, catalytic cracking and blending. The main components are high-octane alkylate, technical isooctane, toluene, pirobenzol and alkyl benzene, ethyl fluid.
The main indicator of the quality of gasoline is its antiknock rating. This ability to burn fuel without detonation of a reciprocating engines with spark ignition, which is estimated octane number and describe the operational and environmental characteristics of transport. To provide antiknock rating and high octane number for aviation fuel add different antiknock additives. The most effective now is Tetraethyl Lead (TEL).

Today all the known brands of aviation gasoline used TEL as antiknock additive good despite the toxicity. Therefore, development of new environmentally safe aviation gasoline is topical modern problem that needs solving.

One solution to this problem is the introduction of the aviation gasoline instead of tetraethyl lead aliphatic alcohols, for example, ethanol, methanol, buthanol.

Their impact on gasoline are known worldwide. With the addition of even 10% ethanol gasoline enriched with oxygen, which promotes more complete combustion and reduce emissions of carbon monoxide by 30%. Also, a decrease toxic emissions by 30% and emissions of volatile organic compounds – more than 25%. Using a mixture of gasoline and ethanol, E10, allowed all the major car manufacturers, while improving engine performance by adding 2,3 octane units to detonation resistance fuel prevents engine overheating, acts as antifreeze fuel system and does not cause contamination of the fuel injectors.

This was the main motivating factor for the performance of our research. We created a hydrocarbon mixture, consisting of 43,0% of gasoline hydrotreatment of catalytic cracking, 40,0% of gasoline of catalytic reforming, 14% of raffinate and 3% toluene (as a Base Gasoline Mixture, BGM). In this base mixture we have determined the content of lead additives in a concentration of 0,0005 g per dm3. It is absence. This original motor octane number (MON) was 80,4.

To improve and modifications of this base gasoline mixture 5%, 10%, 15% ethanol we are added. Then investigated antiknock rating of new gasoline mixture. Methanol as a representative of aliphatic alcohol was excluded as the a highly toxic element. The results are presented in Table 1.

Table 1. Impact modified base gasoline mixture (adding aliphatic alcohol - ethanol) in octane number

№	Research sample	MON
1.	Base Gasoline Mixture (BGM)	80,4
2.	BGM + 5% ethanol	81,3
3.	BGM + 10% ethanol	82,7
4.	BGM + 15% ethanol	84,6

According to research results (Table. 1), the addition of 15% ethanol increases the octane number almost 5 units from BGM.

These are our first results obtaining environmental aviation gasoline.

While this is not enough. Interest is butanol. Further researches will be linked to the modification of BGM by other high-octane components (or additives) up to the level of MON 100.