AGREEMENT ON SCIENTIFIC AND TECHNICAL COOPERATION

Tambov May 02, 2024

Federal State Budgetary Educational Institution of Higher Education "Tambov State Technical University" (TSTU) represented by the Rector, Professor, Doctor Mikhail Nikolaevich Krasnyansky, acting on the basis of the Charter, on the one hand, and

IRM-CERD - Medicinal Research Institute (IRM) of the Djiboutian Centre for Studies and Research (CERD), Djibouti (IRM - CERD) represented by the Director General Fotouma Abdul-Latif (Dr.), acting on the basis of the Charter, on the other hand, jointly referred to as the “Parties”, and each individually as a “Party”, have entered into the following agreement.

1. SUBJECT OF THE AGREEMENT

1.1. The subject of the agreement is the conduct by the Parties of research and development within the framework of the implementation of the joint project “Dry and wet torrefaction of agricultural waste to obtain biochar as a multifunctional product” (hereinafter referred to as the Project).

1.2. This agreement enters into force on the date of entry into force of the Agreement on the Provision of a Subsidy between TSTU and the Ministry of Science and Higher Education of the Russian Federation, concluded based on the results of the selection for the provision of grants in the field of science in the form of subsidies from the federal budget to ensure that Russian scientific organizations and (or) higher education organizations jointly with organizations in African countries conduct scientific research within the framework of ensuring the implementation of the program of bilateral and multilateral scientific and technological interaction (code 24-075-61691-1-1494) and after receiving a positive conclusion from the Ministry of Science and Higher Education of the Russian Federation, as provided for in Part 4 of Article 105 of Federal Law No. 273-FL of December 29, 2012 "On Education in the Russian Federation".

1.3. In the case of non-occurrence of the conditions specified in paragraph 1.2. of this agreement, the agreement will be deemed terminated.

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2. TERMS OF THE AGREEMENT

2.1. The Agreement will commence on the date of conclusion of this Agreement, which will enter into force in accordance with the condition specified in paragraph 1.2, and will end on December 31, 2025.

2.2. Work under the Project will be performed in two stages:

- the first stage will commence on the date of entry into force of this Agreement in accordance with the condition specified in paragraph 1.2, and will end on December 31, 2024;
- the second stage will commence on January 1, 2025, and will end on December 31, 2025.

3. VOLUMES OF ATTRACTED FINANCING AND THEIR SOURCES

3.1. Financial support for the work carried out by TSTU is provided by a subsidy allocated by the Ministry of Science and Higher Education of the Russian Federation in the amount of 20,000,000 (twenty million) rubles, including:

in 2024 - 10,000,000 (ten million) rubles;

in 2025 - 10,000,000 (ten million) rubles.

3.2. Financial support for the work carried out:

IRM - CERD: 11,000,000 (eleven million) Russian rubles, equivalent to 21,300,000 Djiboutian francs (1 RUB = 1.94 DJF), including:

in 2024 - 5,500,000 (five million five hundred thousand) Russian rubles (10,650,000 Djiboutian francs);

in 2025 – 5,500,000 (Five million five hundred thousand) Russian rubles (10,650,000 Djiboutian francs).

Financial support is provided from funds received for the implementation of the project: BIOTECHNET (2022-2025) – Enhancing biotechnology know-how in the Horn of Africa.

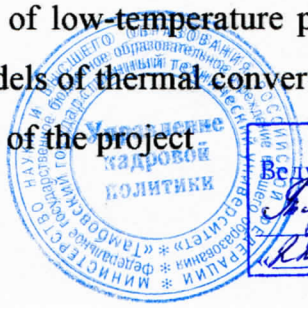
4. DISTRIBUTION OF WORK BETWEEN THE PARTIES

4.1. Work carried out within the framework of the first stage of the Project (from the date of signing the agreement until 31.12.2024).

Work performed by TSTU:

1. Analytical review of existing methods of low-temperature pyrolysis (torrefaction) of biomass, including a review of mathematical models of thermal conversion of biomass

2. Conducting patent research on the topic of the project



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3. Development and manufacture of a laboratory setup for studying exothermic processes occurring in biomass torrefaction processes, and a laboratory furnace suitable for use in African farms, for studying exothermic processes occurring in the process of biomass pyrolysis

4. Study of the physicochemical and thermal properties of agricultural waste typical for Russia (wheat straw, corn stalks and cobs, sunflower husks) and for African countries (waste from olive oil production, coffee husks, date palm waste, sugar cane bagasse)

5. Study of the process of wet torrefaction of selected agricultural waste and the characteristics of the resulting biochar depending on the temperature and duration of the process;

6. Study of the chemical composition of non-condensable products of wet torrefaction and condensate of waste superheated steam used in the process of wet torrefaction of selected agricultural waste, and assessment of the possibility of obtaining high added value products from condensate

7. Study of the dry torrefaction process of selected agricultural waste and characteristics of the obtained biochar depending on the temperature and duration of the process

8. Study of the chemical composition of condensable products of dry torrefaction of selected agricultural waste

9. Mobility of two TSTU employees to Morocco (Sultan Moulay Slimane University) and to Ethiopia (Institute of Bio and New Technologies).

Work carried out by IRM - CERD:

1. Laboratory optimization of biochar production from date palm leaves and branches, study of the effect of changing the temperature and processing time in order to maximize the biochar yield and the quality of the final product; comparison of the characteristics of the obtained biochars with those of the biochars obtained by TSTU using dry and wet torrefaction

2. Laboratory testing of the pyrolysis furnace developed and manufactured by TSTU for home cooking or heating in combination with the production of biochar from date palm leaves and branches (tests are conducted in the laboratory and on a local farm together with farmers

3. Analysis of the properties of biochar obtained in the pyrolysis furnace developed and manufactured by TSTU to study the physical, chemical and biological properties of the produced biochar, including pore structure, chemical composition, water and nutrient retention capacity

4. Optimization and testing of the biochar obtained by TSTU using dry and wet torrefaction methods and the biochar obtained in the pyrolysis furnace as an innovative bioadsorbent for capturing and concentrating organic compounds such as polyphenols from olive oil mill

wastewater and coffee production waste (using biochar samples provided by TSTU, USMS and BETIN).

4.2. Work performed within the framework of the second stage of the Project (01.01.2025 – 31.12.2025).

Work performed by TSTU:

1. Research of exothermic effects arising during dry and wet torrefaction and pyrolysis of selected agricultural waste, including:

- determination of temperature ranges corresponding to the manifestation of exothermic effects during torrefaction and pyrolysis of selected agricultural waste;

- experimental research of exothermic effects during torrefaction and pyrolysis of selected agricultural waste with variation of process parameters (type of processed material, mass and height of loading, heating rate, final temperature of torrefaction and pyrolysis);

- determination of the contribution of secondary processes to the magnitude of exothermic effects

2. Refinement of the design of dry and wet torrefaction units and a pyrolysis furnace taking into account the studied exothermic effects

3. Development and verification of a mathematical model of the pyrolysis and torrefaction process taking into account the possible occurrence of local overheating centers

4. Conducting a feasibility study for choosing the optimal technology for torrefaction and pyrolysis of agricultural waste

5. Development of practical recommendations for the application of the selected optimal technology for pyrolysis and torrefaction of agricultural waste

6. Mobility of two TSTU employees to the Djibouti Research Center, Djibouti

Works performed by IRM - CERD:

1. Physical and chemical activation of the obtained biochar (fine grinding, secondary pyrolysis at higher temperature, acid and alkaline activation) to achieve increased stability and efficiency of biochar use as a bioadsorbent (in collaboration with the Moroccan partner 3BIO-USMS.

2. Testing of the obtained biochar for the adsorption of polyphenols from olive oil mill wastewater (in collaboration with the Moroccan partner 3BIO-USMS).

3. Feasibility studies of potential ways to increase the value of dry and wet torrefaction by-products, including non-condensable gases ("torgaz") and process liquids, for the production

of energy, chemicals and water treatment (in collaboration with the Russian partner TSTU).

4. Socio-economic and life cycle analysis of the selected dry and wet torrefaction and pyrolysis technologies developed within the project, based on case studies or modeling, with an assessment of the environmental impacts of biochar production, including greenhouse gas emissions, energy consumption and resource use (jointly with the Russian partner TSTU).

4.3. The parties, by mutual agreement, may use the scientific infrastructure of TSTU, 3BIO-USMS, BETIN, IRM - CERD to perform work under this agreement.

4.4. The Parties will jointly prepare and agree on reporting documentation, including documents on the costs incurred, for the stages of the Project implementation in accordance with the Work Plan and the Procedure for assessing the fulfillment of obligations under the Grant Agreements in the form of a subsidy, concluded within the framework of ensuring the implementation of the program of bilateral and multilateral scientific and technological cooperation provided for by the event of subprogram 4 "Formation and implementation of comprehensive scientific and technical programs for the priorities of the Strategy for Scientific and Technological Development of the Russian Federation, as well as scientific, technological and innovative development in a wide range of areas" of the state program of the Russian Federation "Scientific and Technological Development of the Russian Federation". A complete set of reporting documents for the stage is formed and submitted to the Ministry of Science and Higher Education of Russia by the Grant Recipient.

4.5. For operational interaction during the project implementation, the Parties have appointed coordinators:

- from TSTU - Rafail Isemin, PhD, penergy@list.ru
- from IRM - CERD - Fatouma Mohamed Abdul-Latif, PhD, fatoumaabdoulatif@gmail.com

5. RIGHTS OF THE PARTIES TO THE RESULTS OF THE WORK

5.1. In the event of the creation of joint protectable intellectual property objects, the rights and obligations of the Parties shall be determined by a separate agreement between the Parties.

5.2. When using previous intellectual property within the framework of the implementation of this project, the Parties shall conclude additional license agreements, which shall be the subject of independent interaction between the Parties.

Управление кадровой политики

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6. PRIVACY REQUIREMENTS

6.1. In the event that one of the Parties imposes a requirement of confidentiality on the information transferred, each Party will maintain strict confidentiality with respect to technical, commercial and other information received from the other Party under this Agreement and will take all possible measures to protect the received information from disclosure.

6.2. Transfer of information to third parties, publication or disclosure of such information may be carried out only with the consent of the other Party.

7. SPECIAL CONDITIONS

8.1. The Agreement assumes that in case of failure to fulfill obligations, the Parties do not have the right to make any claims that may be considered grounds for consideration of the case in court, with the exception of issues of copyright infringement.

8.2. Changes and termination of this Agreement are possible by agreement of the Parties upon prior proper notification of the Ministry of Education and Science of Russia.

8.3. This Agreement is made in 4 copies, 2 copies for each of the Parties.

8. SIGNATURES OF THE PARTIES

Tambov State Technical University (TSTU)

Rector Dr. Prof. Mikhail Krasnyanskiy

Signature:

Seal

Medicinal Research Institute (IRM) of the Djiboutian Centre for Studies and Research (CERD)

Director Dr. Fatouma Mohamed Abdoul-latif

Directrice de l'Institut de Recherches Médicinales du CERD

Signature:

Seal

La Directrice

КОПИЯ ВЕРНА

Ведущий специалист по кадрам

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