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

3BIO-USMS - Laboratory of Biotechnology, Bioresources and Bioinformatics (3 BIO) of Sultan Moulay Slimane University (USMS) - Morocco, hereinafter referred to as 3BIO-USMS, represented by the Head of Laboratory of Biotechnology, Bioresources and Bioinformatics, Full professor at Sultan Moulay Slimane University Tarik Ainane, acting on the basis of the Charter, on the other hand, collectively 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. If the conditions specified in clause 1.2 of this agreement do not occur, the agreement shall be considered terminated.

2. TERMS OF THE AGREEMENT

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

2.2. The work within the framework of the Project is carried out in two stages:

- the beginning of the first stage – from the date of entry into force of this agreement in accordance with the condition specified in clause 1.2, the end of the first stage – December 31, 2024;

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- the beginning of the second stage is from January 1, 2025, the end of the second stage is 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:

3BIO-USMS: 500,000 (Five hundred thousand) Russian rubles, which is equivalent to 54,000 Moroccan dirhams (1 MAD = 9.13 RUB), including:

in 2024 – 250,000 (two hundred fifty thousand) Russian rubles (27,000 Moroccan dirhams);

in 2025 – 250,000 (two hundred fifty thousand) Russian rubles (27,000 Moroccan dirhams).

Financial support is provided by funds received for the implementation of the project: PRIMA CombiFarm (2023-2025) - Combining low-cost biochar, biogas, and cyanobacteria fertigation technologies with low-input crops for sustainable bioproducts in smart circular farming systems.

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 carried out 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 subject of the project

3. Development and production 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 biomass pyrolysis processes

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

5. Study of the wet torrefaction process 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 wastes, and an assessment of the possibility of obtaining high-added-value products from the condensate

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

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

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

Work performed by 3BIO-USMS:

1. Testing of the pyrolysis furnace developed and manufactured by TSTU for home cooking or heating in combination with the production of biochar from olive oil production waste (testing is carried out in laboratory conditions and on a local farm together with farmers)

2. Study of chemical composition and physical properties of biochar obtained in a pyrolysis furnace.

4.2. Works carried out within the framework of the second stage of the Project (01.01.2025 – 31.12.2025).

Work carried out by TSTU:

1. Studies of exothermic effects arising from dry and wet torrefaction and pyrolysis of selected farm wastes, including:

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

- experimental studies 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 installations for dry and wet torrefaction 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

Work performed by 3BIO-USMS:

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1. Study of the production of biocoal briquettes by pressing biocoal obtained from TSTU by dry and wet torrefaction methods together with liquid residues, such as wastewater from olive oil factories, using a simple manual pressing device followed by drying in the sun.

2. Testing biochar produced by a plant developed by a Russian partner as a soil improver for water and nutrient retention in the cultivation of valuable drought-resistant aromatic crops grown in greenhouses such as mint, thyme, rosemary

3. Economic analysis of dry and wet torrefaction technologies applied to large-scale recycling of waste from the Moroccan agro-food industry, including olive oil production waste.

4.3. The parties, by mutual agreement, may use the scientific infrastructure of TSTU and 3BIO-USMS to carry out 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 prompt interaction during the project implementation process, the Parties have appointed coordinators:

- from TSTU – Rafail Isyemin, PhD, penergy@list.ru

- from 3BIO-USMS – Tarik Ainane, PhD, ainane@gmail.com

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

5.1. In case of the creation of joint protectable intellectual property objects, the rights and obligations of the Parties will 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 will enter into additional license agreements, which will be the subject of independent interaction between the Parties.

6. PRIVACY REQUIREMENTS

6.1. In case 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 information received from disclosure.

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

7. SPECIAL CONDITIONS

7.1. 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.

7.2. The amendment and termination of this Agreement are possible by agreement of the Parties upon prior proper notification of the Ministry of Science and Higher Education of Russia.

7.3. This Agreement is drawn up in 8 copies, 2 copies for each Party.

8. SIGNATURES OF THE PARTIES

Tambov State Technical University (TSTU)

Rector **Dr. Prof. Mikhail Krasnyanskiy**

Signature:

Seal

Laboratory of Biotechnology, Bioresources and Bioinformatics Université Sultan Moulay Slimane (3BIO-USMS)

Rector **Dr. Prof. Tarik Ainane**

Signature:

Seal

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