Графики зависимости и осциллограммы

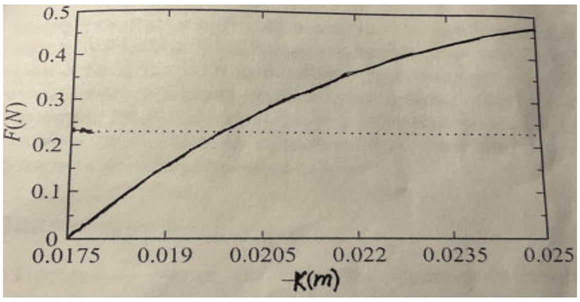
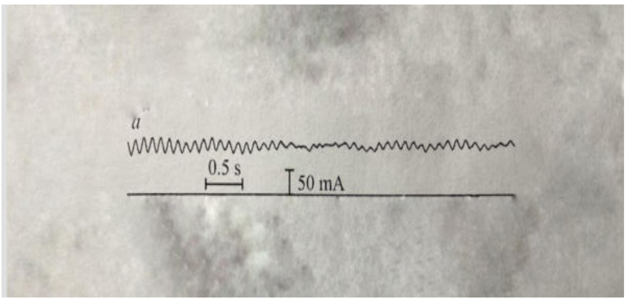
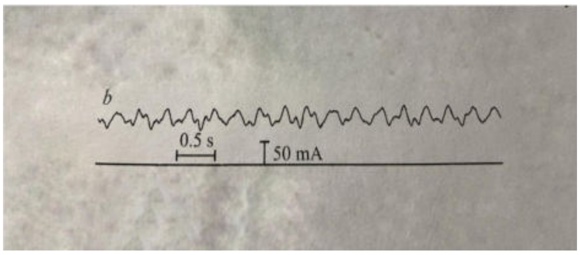


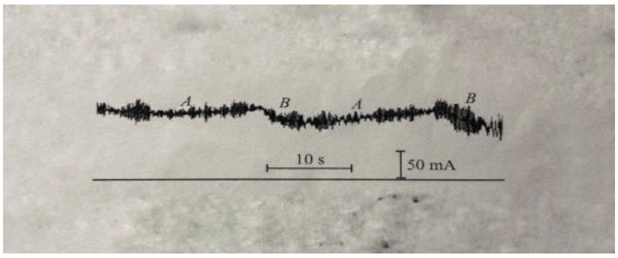
График № 1.
Зависимость силы, действующей на постоянный магнит от положения магнита.



Осциллограмма № 1.
Ток в катушке, связанный с колебаниями магнита по вертикали



Осциллограмма № 2.
Ток в катушке, связанный с колебаниями магнита по горизонтали



Осциллограмма № 3.
Ток в катушке в процессе Настройки баланса моста

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EFFICIENT USAGE OF HEAT ENERGY IN TECHNOLOGICAL PROCESSES

ЭФФЕКТИВНОЕ ИСПОЛЬЗОВАНИЕ ТЕПЛОВОЙ ЭНЕРГИИ В ТЕХНОЛОГИЧЕСКИХ ПРОЦЕССАХ

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Main types of heat energy used in industrial technological processes have been considered. Those processes are usually used in three temperature ranges. An effective direction of energy saving for heating of industrial premises by gas infrared radiators has been proposed. Main advantages of biogas technologies are emphasized.

Рассмотрены основные виды используемой энергии для промышленных технологических процессов в трех температурных диапазонах. Предложено эффективное направление энергосбережения с помощью обогрева промышленных помещений газовыми инфракрасными излучателями. Подчеркнуты преимущества использования биогазовых технологий.

Keywords: heat energy, industrial technologies, energy saving, infrared radiators, gas, biogas, heating.

Ключевые слова: тепловая энергия, промышленные технологии, инфракрасные излучатели, газ, биогаз, нагрев.

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Energy policy is formed on the base of analysis of the public needs in various types of energy resources and the sources for supply most suitable for satisfaction these needs. Consumers use the following types of energy:

1. Electricity required for community facilities, households, services, industrial technologies, etc.
2. Electricity for all types of electrified vehicles.
3. Heat energy for heating process, heat treatment and industrial technology processes. This type of energy is used in three temperature ranges:

1) low-temperature (less than 100°C) in home units heating, public and industrial buildings heating as well as hot water supply;
2) medium-temperature (range 100–300°C) in food, textile, chemical and other industries for heat treatment;
3) high-temperature (above 300 °C) that covers a range of industrial needs. In technology processes: in ferrous, non-ferrous, cement, machine-building industry, electronic engineering, etc., the required temperature can exceed 1000 °C.

More than 60 % of total volume of energy consumption is used for heat generation, approximately 25 % for transport and less than 15 % for other purposes. Low-temperature heat generation, i.e. heat with a temperature below 100 °C, is about half of that 60 % of energy consumption.

Consumers of low-temperature heat in the sectors of economy are:

1. Agriculture: heating in farms and other production premises, grain drying in elevator, animal feed preparation in farms, fruits and vegetable processing.
2. Housing and communal services: heating of buildings, berthing space, hot water supply, food preparation in public and family catering.
3. Textile industry: heating of buildings, bleaching and dyeing of yarn, textile drying.
4. Wood-processing industry: wood drying before its machine processing, drying of painted wood products, impregnation of wood with antiseptics followed by drying, as well as drying of laminated products.
5. Electrical repair industry: impregnation process of electrical machine winding insulation in impregnation varnish or compound.
6. Bread products: dough, bakery products preparation, pasta and crackers drying process.
7. Liqueurs and spirit production: maintaining the temperature regimes for beer-wort and mash fermentation, distillation after maturation, ethanol production.
8. Beer production: beer maturation temperature control.
9. Pharmaceutics: drug forms and ointments production. Utensils and equipment sterilization.
10. Dairy production: milk powder production. Heating of excessively sour or separated (milk passed through a separator) to produce cheese and whey.
11. Greenhouse industry: heating of greenhouses for vegetables and flowers cultivation.
12. Biogas production: maintaining temperature at 55°C in the reactor for biomass decomposition and biogas production.
13. Heating of air supplied in a cold season into subways, underground mines, cold air cutoffs installed in the gates of warehouses, workshops, as well as in the doors of crowded premises (covered markets, department stores).
14. Food industry: fish and meat products drying and smoking processes.

Consumers of medium-temperature heat in sectors of economy are:

1. Food industry: heat treatment of vegetables, fruit and meat before preservation; moisture evaporation in pastes, jams and preserves; fruit drying, soluble powder preparation; vegetables, fruit and meat products pasteurization and preservation process.
2. Sugar industry: pulp soaking, moisture evaporation from the sugar-contained solution, sugar drying process.
3. Electrical industry: drying of electrical machines, apparatus and devices windings insulation before and after impregnation with insulating varnish; drying of electrical insulation after an enamel coating has been applied; drying of insulation coating during the winding wires manufacture; drying of winding insulation before and after impregnation and after painting with enamel is included in technology of electrical machines and apparatuses repair; drying of electrical products when adhesive varnish was used technologically.
4. Mechanical engineering and repairing production: heating parts before their hot pressing on a shaft and bandages and crowns on the disk.
5. Foundry: drying molds before filling them with molten metal.

Consumers of high-temperature heat in industries are:

1. Energy industry: fuel combustion in furnaces of steam and hot water boilers; high energy parameters steam generation for steam turbines; gas and liquid fuels combustion and production of gas to drive gas turbines; thermal processes in internal combustion engines designed for liquid and gas fuels; power steam from nuclear reactors; steam at the outlet of steam turbines used for district heating.

2. Ferrous metallurgy: ore melting in blast furnaces; steel smelting; melting of metals in arc steel-smelting furnaces; heating of ingots before their rolling in rolling mills; metal preheating in presses and forging hammers; heat treatment of details produced by powder metallurgy technology; smelting of metal before casting into molds; ferroalloy production.

3. Mechanical engineering: casting of ferrous and non-ferrous metals; heating of blanks before pressure treatment on presses and forging hammers; heat treatment of products to improve their hardness, toughness and wear resistance.

4. Chemistry: process of oil refining to obtain light products; providing temperature regimes for a standard course of chemical reactions in chemical products manufacture, gasification and raw materials thermal decomposition.

5. Silicate-cement industry: firing of building and refractory bricks; firing of cement clinker for cement manufacture; firing of limestone to produce lime; tiles manufacture and firing.

6. Glass and porcelain manufacture; glass melting and glass products manufacture; firing of clay-based products to make porcelain.

7. Welding production: gas-oxygen welding and cutting; electric welding [1].

It is important for industries to receive more heat from fuel, to use heat with the highest efficiency, to reduce its losses in any possible way, to reduce the cost of energy consumption in the cost of products that increases its competitiveness in domestic and world markets.

The method of rooms heating with infrared radiators is one of the most effective energy saving. It is used as the most economical, environmentally friendly and reliable in operation. Heating of industrial and domestic premises with gas infrared radiators is able to save 40 – 60% of thermal energy and 60% of capital costs of heating system installation.

Radiated gas burners operation is based on the principle of flameless gas combustion by heating of gas-air mixture in thin channels of ceramic panels up to 850 - 950°C and become a source of infrared radiation, converting up to 50 % of energy received during combustion.

Infrared radiation passes through the air without any loss but absorbed by the objects it falls onto, supplying it with the necessary heat even when the ambient air is cold. Due to this reason it is possible to heat only the desired part of the room. The ability to supply heat directly to the heated object makes radiant burner heating systems extremely economical.

High intensity of infra-red radiation absorption determines burners application for various technological purposes: grain drying, juices thickening, food concentrates production, as well as preheating of internal combustion engines in winter, car paintwork drying while repairing, plaster heating in winter time, etc.

Special technological infra-red heaters would solve the problem of energy saving more effectively than commercially available equipment [1].

Thus, infra-red heaters can be used to heat selectively the equipment that is in use at the time. That will reduce natural gas consumption to minimum.

Biological processing of organic waste into combustible gas is a complex microbiological process. Biogas is obtained under anaerobic conditions (without aeration) by microbial decomposition of organic substances resulted in methane and carbon dioxide mixture, as well as a small amount of ammonia, hydrogen, hydrogen sulfide and some other substances formation, depending on initial substances and biogas production technology. Biogas combustible component is methane – from 55 to 85%, the rest is carbon dioxide, ballast that reduces the quality of biogas as a fuel. Due to this reason, specific heat of biogas combustion decreases and additional volume is required in storage.

The main disadvantage of biogas technology is a significant increase of specific capital cost per power-unit.

The advantages of biogas technologies are as follows:

– electric energy production from own raw materials. Pre-treated biogas can be used as a fuel for gas-powered vehicles;

– environmental impact reduction in the livestock complexes and sulfur dioxide emission due to animal waste processing; prevention of methane emissions into the atmosphere;

– obtaining of high-quality, disinfected and well absorbed by plants organo-mineral fertilizers rich in nitrogen, phosphorus, potassium and micronutrients; plant productivity increased by 15 - 20% with the use of biofertilizers, that depends on type of crops;

– improvement of working conditions in livestock complexes and creation of additional highly qualified positions [2, 3].

One of the biomass processing directions is sewage sludge and other organic plant and animal waste decomposition under anaerobic conditions in order to obtain biogas. This process of methane formation is a complex of chemical reactions that consequently take place in certain conditions.

Anaerobic fermentation of sewage sludge is a common technology resulted in volume of sludge reduction, organic substances stabilization, and biogas production. Reduction in sludge volume can lead to significant reduction in cost of its dehydration and deposition, reaching 40% of the total cost of water treatment [4].

Solid (and charcoal), liquid (crude oil and ethanol), gaseous (methanol, hydrocarbon) fuels or directly electricity can be obtained by the biomass conversion.

Methanol and ethanol can be used in a mixture with gasoline in internal combustion engines. In addition, biomass-derived gaseous fuels can be burned directly for cooking, industrial heat generation or power generation. Biogas is used for cooking, light and power generation. Biogas engines run solely on biogas or consume 80% biogas and 20% diesel fuel. When raw biogas is used as a motor fuel, the filling of engine cylinders with fuel (methane) is significantly reduced.

Technological processes of biogas formation are performed in stationary units. The exceptions are city dumps, where the process of biogas formation is practically uncontrollable, as it is influenced by many natural factors.

It is not economically viable to purify biogas with more than 95% of methane, as more than 11 732 kJ of energy is needed for each additional cubic meter of extracted carbon dioxide. For normal operation of a gas-balloon car driven on biogas, it is enough to reach 93% of methane by volume. This degree of biogas purification does not require expensive methods of chemical purification. Biogas purification to the required concentrations can be carried out with the use of physical absorption processes.

Biogas technologies will help to solve the environmental problems urgent for the Republic of Belarus: to reduce greenhouse gas emissions, as the second source of greenhouse gas emission is agriculture.

Biogas plants are modern, environmentally safe sources of energy that have become widely distributed around the world. The Republic of Belarus has a significant potential for development of biogas technologies, and comprehensive application of methods to improve their efficiency along with production of domestic equipment can make biogas plants operation economically more profitable. Therefore, the biogas plant is the unique source of energy production beneficial to the environment.

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ЭКСПЕРИМЕНТАЛЬНОЕ ИССЛЕДОВАНИЕ ПО ПРИМЕНЕНИЮ КАРБОНИЗИРОВАННОГО ТРОСТНИКОВОГО ВОЛОКНА В РАСТВОРНЫХ КИРПИЧАХ

EXPERIMENTAL RESEARCH ON APPLICATION OF CARBONIZED REED FIBER IN BUILDING LIME-SAND BRICKS

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В настоящее время возрастает необходимость сокращения использования неорганических материалов в строительстве, так как они вызывают значительное загрязнение окружающей среды. Для решения проблемы срока службы муниципальных дорожных плит в Беларуси в данной работе предлагается использование уникального для территории Республики Беларусь натурального камышового волокна в качестве добавки к бетонным проницаемым плитам, которое не только повышает морозо- и коррозионную стойкость бетонных проницаемых плит, но и является очень хорошим экологичным строительным материалом. Автор разрабатывает концепцию экспериментальной схемы, соответствующие экспериментальные методы, предлагает несколько осуществимых решений, проверяет осуществимость этих решений методом исследования литературного обзора и вносит осуществимые предложения по решению проблемы срока службы муниципальных дорог.

Nowadays there is an increasing need to reduce the use of inorganic materials in construction, as they cause a lot of environmental pollution. In order to solve the problem of the service life of municipal road tiles in Belarus, this paper proposes the use of a natural reed fiber, unique to the territory of the Republic of Belarus, as an additive to concrete permeable tiles, which not only enhances the frost and corrosion resistance of concrete permeable tiles, but is also a very good green building material. By conceiving the experimental framework and designing the relevant experimental methods, the author proposes several feasible solutions, and verifies the feasibility of these