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EUROPEAN EXPERIENCE CONCERNING AUTOMATION OF MODERN LABORATORY OF MICROBIOLOGICAL TESTING FOOD AND FEED

The need of Introducing European experience in the automation of modern laboratory microbiological testing of food and feed in laboratory practice of bacteriological laboratories of state departments of veterinary medicine of Ukraine are had been analyzed and substantiated.

The main purpose of today's anti-epizootic measures in Ukraine is developing and introduction of programs for the protection of the country from epizooties and liberation of existing infectious diseases, ensuring sustainable veterinary welfare of livestock, receiving high quality livestock products and protection of the population from diseases common to man and animals.

It follows that one of priority directions is considered provide research institutes, laboratories, diagnostic centers with modern equipment, automated systems for monitoring, screening and communication, modern highly sensitive and specific means of diagnosis.

As previously stated company bioMerieux Industry (France) offers a wide range of solutions to improve the quality and safety of food and feed by optimizing workflows and automation of microbiological laboratory.

Optimizing your workflow and automation of microbiological laboratory – are:

– accelerated laboratory processes;
– complete traceability on each stage;
– compliance with international standards;
– easy and recognized technology;
– obtaining reliable results in shorter time;
– cost savings, costs and time.

Complex decisions for optimizing laboratory work of microbiological testing of food and feed include full automation, from sampling to the isolation and identification of microorganisms.

Traditionally, microbiological research are begun with the preparation of nutrient media, solvents and paints. In laboratory practice commonly are used dry or ready commercial culture media. Preparation of

Fig. 1. Ready culture media

which is carried out in accordance with the manufacturer's instructions. The preparation of culture media, solvents, paints the components in accordance with applicable regulations. Culture media are used for research must meet the requirements of ДСТУ ISO 11133-1 [1] та ISO 11133-2 [2].

The company bioMerieux (France) offers the machine for preparing of nutrient

Fig. 2. Apparatus for the preparation of culture media MasterClave 09/528/60

media MasterSlave 09/528/60. This device is a modern automated solution to make easy and quick preparation of high quality of nutrient media: agar and broths. The entire cycle of the work of this device consist three steps: adding dry basis to the machine and mixing with distilled water in appropriate proportions; Automatic cooking process, pre-programmed according to the mode of preparation environment (there are up to 40 cycles per memory device), if necessary, can be included additional ingredients – vitamins, blood, selective additives, etc. spill protection in laboratory dishes at selected temperatures. Wide model range allows you to cook from 1 (MasterClave® 09) to 60 liters of medium (MasterClave® 60). MasterSlave ensured homogeneity and sterility of environments, traceability and reproducibility of the process, safety – for a laboratory technician.

BioMérieux company has 50 years of experience in the design and manufacture of dry and prepared nutrient media for laboratory clinical and industrial microbiology and ensures high growth properties, providing the enrichment selectivity (Liquid selective media) and ease of interpretation of results using dry basis and

Fig. 3. Chromogenic medium

selective supplements in studies of food and feed, and so on.

Thanks to significant investments in the research activities, the company regularly offers unique innovations of high informative value according to current international standards and the highest quality, such as chromogenic medium. Application of chromogenic media during microbiological testing can reduce the amount of work and get results faster.

For example, on ALOA medium for species identification of the genus *Listeria* Lister form turquoise colonies and pathogens – *Listeria monocytogenes* and *L. ivanovii* – turquoise colonies of white precipitation zone around them. During the incubation recycling phosphatidylinositol – phospholipase PI-PLC L-alpha-fosfatydyl-inositol is carried out, resulting in colonies formed around the white zone of precipitation, this phenomenon is connected with the chromogenic substrate 5-brom-4-chlor-3-indoxyl-beta-D-hlyukopiranozid to be entered in the environment to identify the enzyme beta-D-glucosidase characteristic for all *Listeria spp*.

For providing quality and safety storage and transport of samples of food and feed company bioMerieux Industry offers wireless temperature monitoring system and environmental parameters Labguard™. This system are represented by the diversity Labguard sensors for on-line monitoring of the physical parameters of the conditions of production, storage and transportation of products, temperature sensors, humidity, pressure, CO_2, closing the door control equipment, transmitters for wireless communication and data transmission, as well as necessary software. Using this system allows to carry out round the clock monitoring temperature and other physical parameters in real time. It has unlimited choices of controlled objects: refrigerators, freezers, incubators, ovens, sterilizers, cold rooms, warehouses, kitchens, Kettering, laboratories, vehicles etc. automatic system alerts and messages: e-mail, SMS, RSS, Phone, PC etc.; wireless components and data; flexible modular configurations: from small labs to multilevel and integrated production, user access to web-based system at any time from any place of the world, instant access to customer support and tracking bioMerieux and safety: double storage and professional database and Compliance EN ISO 17025 [3], EN ISO 15189 [6], ISO 7218 [4], EN 12830 [7], GMP/GLP, 21 CFR part 11 [8].

Fig. 4. Device for automatic bottling mediums series APS™ One

The technology of the new generation and a new standard of excellence with modern bottling of media options that meet the needs of demanding users of AES Chemunex (structural division of bioMérieux, France), the devices for automatic bottling culture media APS™ Series One, carrying out bottling the finished culture media using metering pump in a petri dish. To move the cups while working are used rotary machine. The device automatically opens and closes the empty cup filled cup immediately after the spill UV rays to eliminate the risk of contamination, tagging them with a printer (optional accessory). New patented system of filling cups and dosing environment APS™ One delivers maximum reliability and ideally even spill protection.

Built-in cooling system reduces the time of solidification of agar and reduces condensation. In manual or semi-automatic mode, using internal or external peristaltic pump (RMO5™), you can make the bottling glass dishes in any configuration (test tubes, flasks) volume 1–1000 cm^3.

For sample preparation the samples of food and feed for microbiological testing is recommended to use automatic homogenizer Smasher™ (AES Chemunex).

Fig. 5. Automatic homogenizer Smasher™ (AES Chemunex)

On the principle of work Smasher™ homogenizer blade peristaltic homogenizing liquids and solids directly into bags for sample preparation by combining two mechanical processes – is based on destruction and mixing simultaneous conduct which ensures optimum recuperation cells. This device is 20–30 times quieter than counterparts (the noise that it creates less than 50 dBA, which makes it possible to work even in the library), provides the crushing weight of a sample of 5–400 cm^3 in just 10 seconds – 3 min.

Also for sample preparation company bioMérieux proposes to use the automatic gravity dilutor Dilumat® from AES Chemunex, which provides a sample weighing and fast, high quality and standardized filling the appropriate number of medium/solvent in packets for homogenization – so

Fig. 6. Automatic gravity dilutor Dilumat®

for 1 minute. You actually get: accurate weighing of the sample is proportional to the dosage nutrient medium/solvent. To dilutor Dilumat® can be connected packets of commercial prepared culture media and media bottle with your own production, as this device can be connected directly to devices for the preparation of media (e.g. MasterSlave 09/528/60). It can be used for dispensing liquid and agar media in laboratory glassware. Using this device allows laboratories to save time and money by fully automating the process of sample preparation.

Fig. 7. The process of sample preparation

Laboratory for microbiological testing of food and feed daily counting of microorganisms involved , reflecting the microbiological quality and safety of the various stages of the production process of enterprises – from raw material to finished product.

Company bioMérieux, using their experience and potential in the development of culture media and automated systems, in close cooperation with international experts in food microbiology, has developed a system of TEMPO® – the first automatic station for direct counting sanitation indicators – indicators of quality in food products, food raw materials and animal feed and environmental samples. One TEMPO® system allows you to put up to 500 tests per day. TEMPO system consists of two ergonomic workstations: sample preparation station and the station records of the results. On records of the results station are made automatic TEMPO reader and interpretation of results, and data management (processing, storage, sharing, etc.). Sample preparation station and station keeping results are related by WIFI wireless connection and exchange data in real time, even when installed in different rooms. Accuracy of TEMPO® is recognized around the world and validation of AOAC International certified by AFNOR and in accordance with the recommendations of ISO 16140 [8] as an official alternative method of research quality indicators. Together with TEMPO you can:

– much faster to control raw materials and feed for sanitary indicative bacteria;

– faster introduce corrective actions in case of any discrepancies by microbiological parameters;

– much faster to produce the goods in implementation;

– increase the efficiency of the laboratory;

– unload the state lab for less grind.

Definition of pathogens in food and feed is a priority task of veterinary medicine in the country. Such pathogens as Salmonella, Listeria, Vibrio should be controlled.

VIDAS® – automatic analyzer number 1 in the world for the express routine monitoring of pathogens in food products, food commodities and animal feed has all the basic protocols for detecting pathogens.

The method is performed on immunofluorescence analyzer meets all the requirements that apply to alternative methods according to ISO 16140 [8], namely:

– method is approved by the International Standardization: French Association for Standardization AFNOR,

Fig. 8. Mini VIDAS®.

Fig. 9. VIDAS®.

Science Association of Analytical Chemistry, AOAC, Association for Standardization Nordic NORDVAL, Health Canada, the German Institute for Standardization DIN;

– ease of use of the method and its automation: the first and the second day is held nonselective and selective accumulation. 2 night broth savings introduced to strip test system, which is then placed in a device, the device is chosen research program automatically. The last three steps take less than 5 minutes. Then the analysis, the device gives the result for 45–120 min. (depending on the pathogen, which conducted the study);

– compact and automated processes: all procedures of immunofluorescence analysis are performed by instrument, the results are printed out in the form of integrated printer protocol;

– saving time doctors and technicians: analysis continues 70–80 min. While you can test up to 12 samples at the same time – saving consumables, culture media (in the case of a negative result – no need seeding on solid differential diagnostic environment);

– standardization of the results: for each set of test system «VIDAS» are included calibration solutions. Calibration is performed every 2 weeks. Each analysis is the automatic control of the shelf life and quality test kits.

If necessary, you can use the well-known test systems API® (bioMérieux, France), the appearance of which at one time had a revolution in microbiology, as it became the first ever successful attempt to streamline procedures for routine microbiological examination. API – the tablets in mikrohole which are dehydrated biochemical substrates. When making a suspension culture in the hole, it interacts with the substrate, resulting in there «color reaction» similar rows of Hiss. The idea is very simple, but the fact of dismissal of routine laboratory preparation of substrates factory standardization of the process and higher product reliability were good bridgehead for the development of new technologies in microbiology.

Fig. 10. Test systems API®

Fig. 11. Automatic analyzer VITEK® 2 Compact

A special place is occupied by modern bacteriology fully automated equipment, which filling test kits suspension, incubation of cultures, reading results (species identification) and its treatment are no routine laboratory staff participation. Such devices are designed to accelerate the results of species identification. For example, implemented in analyzers VITEK® 2 Compact (bioMérieux, France) dynamic monitoring biochemical reactions of microorganisms with multiple substrates and original software to yield results of species identification of microorganisms in 2–3 hours. In addition to the identification of microorganisms present device determines the sensitivity of the selected pathogen to antibiotics. These technical innovations, freeing staff time thereby affecting the working process microbiological laboratory. The anxiety of specialist microbiologist is: sample preparation, obtaining a pure culture, setting benchmarks tests, preparation of suspensions of test organisms, plant test of the machine and the input of the sample solutions. Automatic analyzer VITEK® 2 Compact allows species identification of the broadest spectrum of microorganisms (Gram-negative and Gram-positive anaerobic bacteria, yeast, bacillary, etc.). Proposed model for 15, 30 or 60 studies simultaneously.

Therefore, optimization of business processes and automation of modern laboratory microbiological testing of food and feed in Ukraine will improve the reliability and timeliness of diagnosis, significantly increase the effectiveness of national veterinary laboratory affairs in general and veterinary medicine to bring Ukraine to the level of European standards.

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Європейський досвід щодо автоматизації сучасної лабораторії мікробіологічних досліджень харчових продуктів і кормів. *Н. Меженська, Т. Гаркавенко, І. Семенчукова*

Проаналізовано й обґрунтовано необхідність використання європейського досвіду щодо автоматизації сучасної лабораторії мікробіологічних досліджень харчових продуктів і кормів у лабораторній практиці бактеріологічних відділів державних лабораторій ветеринарної медицини України.

Европейский опыт автоматизации современной лаборатории микробиологических исследований пищевых продуктов и кормов. *Н. Меженская, Т. Гаркавенко, И. Семенчукова*

Проанализирована и обоснована необходимость использования европейского опыта автоматизации современной лаборатории микробиологических исследований пищевых продуктов и кормов в лабораторной практике бактериологических отделов государственных лабораторий ветеринарной медицины Украины. ○

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