

Point inspection management of equipments and instruments promoted practical teaching of microbiology

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Abstract: This paper analyzes the application characteristic of instruments and equipment in microbiology laboratory, and point inspection management was applied in microbiology laboratory. Through establishing regulations, classification point inspection, applying five bindings, completing point inspection checklist and promptly solving failure, point inspection management was effectively implemented. After the implementation of point inspection management, laboratory instruments and equipment utilization rate increased, maintenance cost reduced, and safety level was also enhanced. The point inspection management is a well-proven method for equipment and instrument management in microbiology laboratory.

Keywords: Point inspection, equipments and instruments, microbiology, practical teaching.

Introduction

Microbiology is an important basic course of life science, having strong practical application. The practical teaching of microbiology might cultivate college students to relate theory with practice, and enhance their ability to observe, analyze and solve problems. It is also an essential part in training high quality and innovative talents [1,2]. Microbiology practice teaching has repeatable, universal and periodical characteristics. To cultivate innovative college students, laboratory instruments and equipments should continuously and effectively keep in good condition. Thus, students might show enthusiasm in microbiology practical teaching and the teaching effect was promoted accordingly [3].

Point inspection management is an instrument or equipment checking system according to certain standards and period. It checks certain parts for early detection of potential failures of equipment through human sense organs (visual, touch, enquiry, hearing and smelling) and instruments testing. Once potential failures were detected, they would be eliminated in time by fixing. Therefore, instruments or equipments were continuously kept better status via point inspection system. Equipment point inspection system is not only an examination way, and is a kind of system and management methods. Many Japan enterprises have a set of detailed, standard procedure in point inspection field [4, 5]. Laboratory instruments and equipment plays a very important role for science and technology innovation of college students. Currently, microbiology laboratory of our college served many teaching and

scientific research tasks [6]. Point inspection management can give full play to the function of microbiology laboratory under the premise of security, better training the innovative ability of students.

In this paper, considering the real application of microbiology laboratory of our school, point inspection system was applied to manage instrument or equipment in the practical teaching process of microbiology. We hope to explore a new model for effectively managing instrument or equipment and further promote microbiology practical teaching.

Application characteristics of instruments and equipments in microbiology laboratory Frequent using and failure

As a basic course of life science, each specialty opens microbiology experiment. Now there are about 8 freshman classes in our school each year, and many courses in curriculum schedule of microbiology experiment were arranged by different classes. Thus, instruments and equipments faced particularly high application frequency. Some apparatuses such as autoclave and fermentation tank run in all working days. Owing to frequent using, machine parts including rubber mattress, safety valve, bearings, sensors and so on, are often subject to aging and failure. In addition, lubricate needs to add in some transmission parts of equipment or instrument [7]. Especially when key equipments break down, many experiments can not be carried out.

High security requirements

Different from general experimental operation, the experimental apparatus and equipment of microbiology have high temperature and pressure characteristics along with certain danger. Autoclave usually runs under 121°C and 0.15 MPa through a series of processes of heating, heat preservation and cooling down. If autoclave was not properly operated, burn or explosion accident was extremely easy to occur. The pipe system of fermentation tank includes air, steam, material, waste water and tap water, etc. These pipe lines were switched, distinguished clearly. Once pipeline switch is wrong, accident such as empyrosis will occur. In addition, during microbial experiment process, some materials or reagents are flammable, so fire safety should be paid attention to. Many experiments often contact much water, and electrical safety needs to be cautioned in appliances application [8, 9]. Besides, cylinder needs to be careful operation to prevent the occurrence of explosive injury when some microorganism was cultivated using carbon dioxide.

Special parts and longer maintenance time

Microbial experiments involved in bacteria observation or preservation, applying ultra low temperature refrigerators and digital microscopy. These equipment parts are more special, can not be purchased from local market usually, and need to order from their manufacturers. When this equipment failure occurs, purchasing spare parts take much more time [10]. After purchase, replacing parts also need some time. This instrument should strengthen management, observing the operation at any time. Once failure symptom appears, repair is immediately implemented. In particular, microbiology laboratory purchased some imported equipment and instrument currently. The process of acquiring accessories related to customs procedures and more time was consumed. Moreover, the repair charge of factory staff is also relatively high. All these matters need to be considered.

Implementation process of point inspection system in microbiology practical teaching

Establishing regulations and widely publicizing

Regulation may ensure that point inspection effectively carried out in microbiology practical teaching. At the beginning of applying point inspection, rules and regulations in relation to point inspection were established. Meanwhile, these regulations were widely publicized among teachers and students. Accordingly, point inspection network system was also constructed, including three levels: laboratory personnel, the department of school facilities and manufacturers [11]. Laboratory technician is responsible for the equipment, most acquainting equipment performance, detecting abnormal situation and organizing to repair equipments and instruments. Usually, the point inspection of laboratory technician effectively achieves with the help

of experiment operator (students or teachers). The personnel of school equipment department possess professional knowledge, diagnosing the abnormal situation of equipment. They usually inspected the key parts of main equipment or instrument once a month. Manufacturer personnel also inspected the equipment at any time. Their work includes guiding technicians and repairing personnel, inspecting key instruments drawing parts using especial tools, and grasping the dynamic status of equipment.

Classification point inspection to equipment or instrument

There are many instruments or equipments in microbiology laboratory. If all the equipments were checked at the same point inspection standard, workload was tremendous, requiring much more human and material resources. To improve efficiency, equipment with high frequent application or large scale instruments was given preference to. Autoclave, intelligent incubator, fermentation tanks, and super clean bench all needs to priority [12]. On the contrary, some equipment or instrument may be general considered. They have little influence to daily experiment, or they might be temporary substituted by the same equipments of other laboratories. These equipment or instrument includes electronic balance, electrothermal blowing dry box, water bath, and so on. As for small facilities such as ultraviolet light, exhaust fans, they might be change at any time, simply paid attention to. In this way, instrument and equipment were managed with classification and stratification, ensured at the most efficient operation with the minimum cost.

Applying five bindings

Five bindings include fixed point, definite method, appropriate standard, reasonable circle and responsible personnel [13]. Fixed point is composed of equipment parts, item and contents. For example, fermentation tank was checked through valve leakage, flow meter accuracy, and controllable sterilization temperature. Definite method is specified regular used to check equipment or instrument. Usually vision, hearing, touch, taste, smell compose of the basic methods, namely five sense inspection. In addition, equipment or instrument was measuring by means of special equipment or tool as occasion requires. Appropriate standard is a ruler to determine whether the checked parts are in normal condition. For example, in microbiology experiment, wear sealing pad of autoclave often needs to replace in time. Reasonable point inspection cycle is very important. Usually, according actual application status, the equipment or instrument was checked before, during and after experiment. Besides, as for some low frequent applying but essential equipment such as ultrasonic cell crushing apparatus,

special management was adopted. Responsible personnel carry out point inspection work. In general, before experiment, laboratory assistant is responsible for point inspection. And during experimental process, operation personnel checked the serviceable condition. After experiment, laboratory assistant and operation personnel together verify the status of applied equipment. Meanwhile, the service engineers of our university also make a comprehensive inspection for important equipment once a month.

Completing point inspection checklist and promptly solving failure

Preparing point inspection checklist includes followed process: the collection of preliminary data, the formulation of draft, simplifying form, exerting trial version, and improving during applying process. Inspection content was ascertained according to reference manual or expert advice. At the same time,

the tools of microbiology laboratory could ensure to check the ascertained item. Usually, each apparatus has a separate checklist. To easily verify and repair, containing manufacturer, type and school uniform number was clearly marked in checklist. Table 1 presents an autoclave checklist. Laboratory technician or experimental operation personnel are responsible for checking applied instrument or equipment according to point inspection plan. And specific state is truthfully and completely recorded in checklist. Point inspection record is an important prerequisite to guide repair broken-down equipment, and is also a key step to convert into prevention from breakdown maintenance for equipment management [14]. Once some potential failures of equipment are found, laboratory technician gives an account toward related official and organize maintenance timely. Thus, equipment or instrument is maximally kept in good condition.

Table-1: Point inspection Checklist of Microbiology Laboratory

Name: Autoclave		Type: LS-50HD	No.: 20140932	Superintendent:	Date:		
Maintenance content and standard		Experimenter checking			Service engineer checking	Manufacturer Checking	Remarks
		Before	During	After			
Sealing pad of Lid	No excessive wear, no rupture						
Pressure gage	Reasonable Indication						
Power switch	No loosening, normal on-off						
Safety Valve	Normal exhaust						
Handle of Lid	No Distortion						
Recorder							

Note: The service engineer of our university usually checks equipment once a month and manufacturer usually checks equipment once a year.

Implementation effects

Improving instrument and equipment utilization rate

After the implementation of point inspection management in microbiology laboratory, instrument and equipment was closely monitored. Once any potential failure of equipment comes, it will be effectively solved in time. Therefore, point inspection greatly improves the application efficiency of equipment. There is more opportunity for college students to do experiment in laboratory, and this is beneficial to improve their ability of operating equipment and solving problems. In addition, tension situation between undergraduate teaching experiment and scientific research experiment gradually eases.

Reducing maintenance cost

Because each inspection has a clear and quantitative assessment standard, the quality of

inspection and maintenance was ensured. Thus, the possibility of sudden accidents decreased to a minimum and the workload of post repair also reduced. Moreover, maintenance is implemented before final equipment failure. In this stage, equipment damage is relatively small, so maintenance cost is greatly reduced.

Enhancing experimental safety level

Laboratory safety is an eternal theme in college. After the implementation of point inspection management, equipment operation with failure virtually eliminated and equipment safety is improved. Doing experiment under safety condition, experimenters feel quite relaxed. Thus, they pay more attention to instrument status. Accordingly, accident occurrence effectively reduces.

CONCLUSION

The implementation of point inspection management in microbiology laboratory, can effectively promote microbiology practice teaching. After the implementation of point inspection management, laboratory instruments and equipment utilization rate increased, maintenance cost reduced, and safety level was also enhanced. The point inspection management is a well-proven method for equipment and instrument management in microbiology laboratory.

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