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Cleaning Technology in Controlled Areas

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Introduction

Cleaning technology is based on knowledge in proper and high-quality cleaning. It should fulfill growing customers' demands. Cleanroom, controlled room, patient room, they have all different usage and even in cleanrooms all surfaces are contaminated with different kinds of dirt, dust, microorganisms and condensed matter. To keep clean is to reduce any pathway ultimately transporting mass into the surface layers. Only two methods have been introduced for removing dust and dirt: ventilation and cleaning. Clean ventilation systems prevent the dust and dirt from accumulating on the surfaces. The criteria that we want to obtain by cleaning differ: to obtain an acceptable perception, both visual and tactile, for hygienic and health concern reasons, and to prevent surface degradation. In this paper, I describe the Finnish way of professional cleaning in controlled rooms and how the procedures can be done. To start, there are some standards and definitions to show the background. Cleaning as a part of contamination control explains some reasons why cleaning should be done properly. Different kind of dirt has been explained to ensure differences in choosing the right cleaning method. Some examples of good procedures are mentioned below.

Cleaning standards and determinations

In Finland, there have been standards to determine cleaning vocabulary since 1983 and for cleaning machines since 1989. In 2010 the Finnish Standards Association SFS published a new vocabulary of cleaning industry (SFS 5967)¹, which combines the old ones and has further determinations. In the standard, the cleanroom cleaning is determined as

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a cleaning to be done in areas where the cleanliness and the area is defined by the standards, for example by the standard SFS-EN ISO 14644-1.

Cleaning can be determined as an assistance work for the main operations. Cleanroom cannot be clean without cleaning. Whyte (2003)² gives in his book reasons, why a cleanroom must be cleaned. He wonders why so much money and effort is used to designing and construction, but only some thoughts are given to making and keeping the room clean. Cleanroom surfaces do get dirty and must be cleaned even if they seem to be clean and no visible dirt can be seen. Ramstorp (2000) explains that the purpose of cleaning cleanrooms and clean zones is to release, collect and remove all undesired contaminants from surfaces with the regard to cleanliness.³

In controlled areas, the latest standard to determine requirements for cleaning in the health care sector is DS 2451-10. The standard makes it possible to establish levels for the cleanliness considering the demands of hygiene in controlled rooms.⁴

Contaminants and dirt

The vocabulary of cleaning industry defines dirt as follows: "Dirt is uncleanness that reduces the value of the use of surfaces"¹. Dirt can be divided into groups consisting of solid materials, chemicals and physical conditions. It is important to define what is to be considered as a contaminant and what is to be considered as a critical contaminant.^{1, 5}

Even in cleanrooms, some dust might be acceptable when it is high up and not reachable, but on process tables, the same dust can be dangerous.

If cleanroom entrance from outside is blocked, the main dirt comes with people or products. In many cases, the dirt in cleanroom might be particles and microbes attached to them, and the main force that holds particles on cleanroom surfaces is the London-Van der Waal's force as an inter-molecular force. Electrostatic forces might occur, but it depends on the type of materials used. After wet cleaning and without proper drying, some biofilm can form on surfaces and there might be some residues of detergent on the surface.^{2, 5}

Cleaning cycle

Cleaning or Zinner cycle⁵ consists of all those things that are needed in the cleaning process. They together create the entire process used to remove particles from surfaces. The components are chemicals, temperature, time and effect. The effect part can be divided into technique and scrubbing as Kääriäinen did in Finland.⁵ In cleanroom facilities, much energy cannot be used, so scrubbing as a mechanical work should be restricted. Chemistry cannot be replaced with using more time, work and temperature. All four components should be included in the cleaning process and the water used must be the same as in the process.

Instructions how to clean and work in cleanrooms

Dimensioning has played an extremely important role in the development of cleaning work in Finland. Dimensioning includes use of time and method standards as a development tool for cleaning work.⁶ Proper working instructions for cleanroom cleaning must be specified, all details should be mentioned. In the working plan, at least these things should be included: Time of cleaning, Work order, Materials used, Equipment and detergents used, Schedule of the work to be done, checking list, in the text specified method explanations and the name of that person who has made the instructions and the updating date.^{2,3,7} Much more attention to the Critical control points should be paid and that might increase the costs. Existing control points vary in different kinds of cleanrooms, which means that every area needs to be calculated separately. When supplying cleaning equipment and agents, the mentioning of the word cleanroom might triple the price of the product. Some equipment from the field of food technology could be used instead of so called "cleanroom products". Good equipment should be easy to sanitize and /or sterilize. The used amount of cleaning agent can nowadays be only 2 ml / 5 l water and there might be cleanrooms that do not need actual cleanroom agents at all if the wipes are made of good quality microfiber. More important, the same type of water should be used as in the process. Surfaces must be clean before they can be disinfected. The challenge of cleaning-controlled rooms includes contamination that cannot be seen, wearing garments, gloves, masks, and head coverings. There should be proper protocols established and proper cleaning tools as well as communication on the cleaning processes provided.⁸

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