

Crystallography in Molecular Biology

Every biological activity is controlled and handled by nucleic acids (DNS) and proteins. All processes can only be understood if the spatial structures of these very complicated macro molecules are known. Especially the geometry of the active centers and their atomic details need to be discovered. Under specific conditions nucleic acids, proteins and even intact viruses build crystals (examples of crystals are given in figure 1). These crystals can be analyzed by using, for example, x-rays. Therefore crystallography is key to molecular biology. Genetic engineering allows diversification of the protein structure and therefore their function. This so called "protein-design" is only possible if the structures of the specific proteins are familiar to us and therefore demand the need for structure analysis. Innovative developments like intensive image forming radiation and planar meters have the capability of generating substantial data in a short time frame. More efficient computers and graphical monitors allow an on-line interpretation of the data and a display of the sophisticated structures. Computer simulations amplify the structural analysis using execution of time dependent dynamic procedures. In particular the complexation of smaller molecules modulatory to proteins is in the focus. Key for "protein-design" is the availability of extensive data banks consisting of mainly structural information obtained by using crystallography. Crystallography in pharmaceutical research opens the door for new possibilities in drug discovery and development.

Common methods of storage

Usually crystallography requires temperatures of 4°C and/or storage at room temperature. This can be realized using climatically conditioned rooms as well as with single refrigeration units. A major impact on the growth of crystals is vibration during storage because of very sensitive structures. Vibration is therefore a critical consideration when contemplating a storage medium for crystallography. Housing a process in a cooled room provides a good solution for storage as vibration issues can be addressed during the design. However, not all laboratory instrumentation, including the equipment associated with crystal growth, are able to function at low temperatures with the precision for which they were designed. In particular fluid handling at different temperatures has a massive impact on material consistency and structure making accurate repeatable dispensing extremely difficult. Stand alone refrigeration instruments must also consider vibration in their built cooling device as this may well be an additional source of unwelcome vibration. The advantage of stand alone units are that the vibration issues along with the temperature, and humidity concerns can be addressed without affecting the conditions of the surrounding equipment required for the process.

The flexibility advantages for stand alone units are therefore much greater especially if the units are portable adjustable and compatible with their surroundings. The series of Kendro Cytomats have all the flexibility expected from stand alone refrigeration units supported by a reputation for worldwide automated system compatibility.

Cytomat® 2 C425 - Specification

Temperature:
Temperature range: +4°C to +25°C
Temperature accuracy: ± 0,7°C

External Dimensions:
Height: 1.101 mm (43.4 in)
Width: 491 mm (19.3 in), excluding transfer station
Depth: 592 mm (23.3 in)

Capacity:
2 standard Kendro stackers
42 standard SBS 96 or 384 well plates

Access time: <20 sec., random access

Interface: Single RS232 for Plate Shuttle System (PSS) and temperature monitoring

Single Transfer Position:
Located at about 340 mm from the table top. Several transfer station options.

Installation:
Preferred for setup on the laboratory table.

Cooling System:
External heating and cooling unit, thermostat liquid and connecting lines allowing installation in max. 2m distance from the Cytomat® 2 C425.

Construction:
Plate Shuttle System, consisting of a lift system, a handler for x/y/z axis movement and a heated automatic access door.
Manual access door, control panel with digital display of actual and set values.

See figure no. 2.

Cytomat® 44 H - Specification

Temperature:
Temperature range: +4°C to +20°C
Temperature accuracy: ± 2°C

External Dimensions:
Height: 1.960 mm (77.17 in)
Width: 1.950 mm (76.77 in), including transfer system
Depth: 820 mm (32.28 in)

Capacity:
44 standard Kendro stackers
924 standard SBS 96 or 384 well plates

Access time: <40 sec., random access

Interface: Single RS232 for Plate Shuttle System (PSS) and temperature monitoring

Single Transfer Position:
Located left between 650mm to 1,170mm from the floor.
Capacity for intermediate storage realized via an outside stacker position.

Installation:
Castors for easy transportation. Adjustable feet for positive location.

Cooling System:
Compressor cooling, with a maintenance free forced air flow. Stacker positions mechanically decoupled for minimized vibration during storage. Automatic defrost with intelligent airflow control to minimize influence on operating conditions. Automatic evaporation of water condensation.

Construction:
Inner and outer casing made of corrosion resistant stainless steel. The working space is easily accessible through two large front doors with a removable middle bar. The front seals are heated to prevent frost accumulation.

(see figure no. 3)

Cytomat® Hotels

For the setup of complete systems in environmentally controlled rooms a variety of different hotels for the storage of microplates has been developed. Starting with 42 standard (SBS size) shallow well plates the modular design is suitable for nearly every amount of storage capacity. The positions of the stackers are mechanically decoupled to minimize vibration during the process. In addition the Kendro Hotel series offers a single point of transfer for easy integration. All instruments are transportable and fit through standard size doorways. A large variety of different transfer possibilities are also available e.g. linear or swap station. Furthermore our customized projects department is capable of providing custom solutions to specific requirements.

Figure no. 4 shows the Cytomat® Hotel with a capacity for 189 shallow well plates in 9 stackers. Figure no. 5 shows the Cytomat 24 Hotel with a capacity of 504 shallow well plates in 24 stackers. The linear system Cytomat 24/48 Hotel is showed in figure no. 6. This modular system is available in two versions with either 24 stackers (504 plates) or 48 stackers (1008 plates).

Summary

Crystallography in pharmaceutical research enables complete new possibilities for drug discovery and development.

Analysis and liquid handling are key for optimal crystal growth systems.

For automated setups storage conditions become more important.

The Kendro Cytomat® product portfolio offer the right solution for either storage in environmentally controlled rooms or as automated modules.

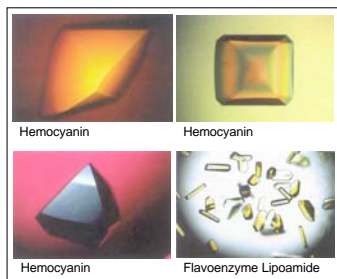


Fig. 1



Fig. 2



Fig. 3



Fig. 4

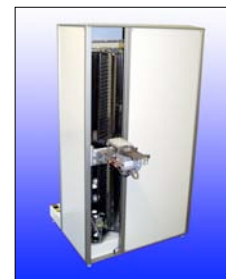


Fig. 5



Fig. 6