SHERWOOD SCIENTIFIC
CHLORIDE ANALYSERS

MODEL 926S
AND CYSTIC FIBROSIS
Model 926S and the diagnosis of Cystic Fibrosis

The Sherwood Scientific Model 926S Chloride Analyser has been widely used for the accurate measurement of chloride ions in sweat samples for many years to give confirmatory diagnosis of Cystic Fibrosis.

The ability to work with small samples down to 100μl or even 20μl gives great flexibility in the methods of sweat generation.

Cystic Fibrosis

A genetic disease, cystic fibrosis (CF) almost always leads to an early death. It is present in one out of every 1,500-2,000 Caucasians born alive. In the UK about 375 children are born with the disease every year. Some die in the neonatal period, some in the first few months of life, and some in early childhood. The average lifespan is 15 years; few of its victims survive to middle age. There is no known cure for Cystic Fibrosis. With early detection, however, a person can hope to slow or prevent the secondary complications, chronic pulmonary disease and pancreatic exocrine deficiencies. Correct diagnosis is essential for proper genetic counselling of the CF patient’s parents.

It is essential to confirm or exclude the diagnosis of CF in a timely fashion and, with a high degree of accuracy to avoid unnecessary testing, to provide appropriate therapeutic interventions and prognostic and genetic counselling, and to ensure access to specialized medical services. In the majority of cases, the diagnosis of CF is entertained because of the presence of one or more typical clinical features and then confirmed by demonstrating an elevated (>60 mmol/L) sweat chloride concentration.

The Sweat Test devised by di Sant’Agnese, was the result of the observation that in hot weather, the depletion of salt in the body caused some CF patients to go into deep shock. di Sant’Agnese and associates examined the sweat of these patients and found increased sodium and chloride concentrations.

Iontophoresis

The sweat glands on a localized area of skin are activated by iontophoretic introduction of Pilocarpine. In the process of iontophoresis, an electric potential is established so that pharmacologically active ions carry a current and are thereby iontophoretically introduced into the skin. Practically, a positive electrode moistened with Pilocarpine is used. The positively charged Pilocarpine radicals introduced into the skin. Practically, a positive electrode moistened with Pilocarpine is used. The positively charged Pilocarpine radicals are removed, the skin cleaned, and sweat collected on a weighed piece of Filter Paper place over the exact region where the Pilocarpine was iontophoresed and covered with plastic to prevent evaporation. The patient is left with the collection Filter Paper in place for some 40 minutes. The film is removed and the Filter Paper is placed immediately in a pre-weighed Petri dish, weighed again, and then eluted with ~10ml distilled water. A 1ml sample of this eluate is then pipetted directly into the sample beaker of the Model 926S Chloride Analyser.

Sweat Collection Macroduct Method

With this method, a Pilocarpine gel is used rather than a gauze pad moistened with Pilocarpine. A Macroduct Sweat collector consisting of a disposable plastic disc containing a length of micro bore tubing is placed precisely over the cleaned area stimulated by the iontophoresis. The sweat is collected in the tubing. It is then dispensed into a sealable container and mixed. 20μl is then transferred the Model 926S Analyser for direct measurement of the chloride content.

Typical Sample

Sweat samples collected after iontophoresis (~200mg) onto paper and extracted with 9.8ml water.

Instrument Operation

Operator Action

1. Switch on. 
2. Add aliquot of acid buffer to mark on beaker.
3. Select 20μl sample by pressing Switch.
4. Press Condition.
5. Calibrate with 20μl standard
6. Add exactly 1ml sample to the buffer in the beaker.
7. Press Titrator.

Calculation

1ml sample aliquot taken = 50 x standard volume used

Sweat diluted 1:50 thus

Result (Cl mmol/l) = Instrument reading x
200

actual weight (mg) sweat taken

References


3 Draft Recommendations of NHS Multidisciplinary Working Group, November 2001

Confirmation of CF

It is the consensus of the panel that the diagnosis of CF should be based on the presence of one or more characteristic CF symptoms in a sibling, or a positive new-born screening test result plus laboratory evidence of a CFTR abnormality as documented by ELEVATED SWEAT CHLORIDE concentration. This was the conclusion of an expert panel convened in the USA to study the laboratory diagnosis of CF2. A similar conclusion was reached by an expert panel in the UK3.

Instrument Response

Operator Action

1. Switch on.
2. Add aliquot of acid buffer to mark on beaker.
3. Select 20μl sample by pressing Switch.
4. Press Condition.
5. Calibrate with 20μl standard
6. Add exactly 1ml sample to the buffer in the beaker.
7. Press Titrator.