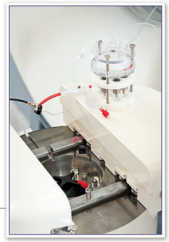
HIDEX RADIOWATER GENERATOR

IMPROVING PET RESEARCH POSSIBILITIES

An automated production system for ^{15}O-labelled H_2O for Positron Emission Tomography studies. Developed to support increased patient safety and reduced staff radiation exposure.

Production of radiowater

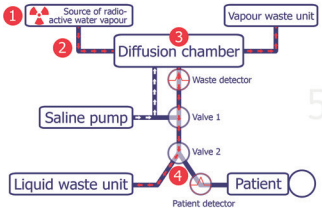
$^{15}O_2$ is produced continuously with a particle accelerator. Target gas is mixed with nitrogen/hydrogen gas and water vapour is produced catalytically. Water vapour is transferred to the bedside radiowater module. The system is designed for continuous and bolus production.



System design

The system is designed for easy operation. Saline flow is controlled with pinch valves and radiation detection is based on plastic scintillators and fiber optics. As a result no electricity is needed in the bedside module. Each patient has an individual sterile disposable diffusion chamber kit for increased patient safety.

The radiowater production process



1. $^{15}O_2$ gas is produced in a cyclotron. $^{15}O_2$ gas is mixed with H_2 and burned in a furnace at 700 °C.
2. The resulting water vapour is transferred into the bedside diffusion chamber.
3. Water vapour is mixed with saline inside the diffusion chamber, between two membranes, hydrophilic and hydrophopic.
4. Radiowater is continuously produced into a decay coil.

PARTS OF THE SYSTEM

Bedside lead shield

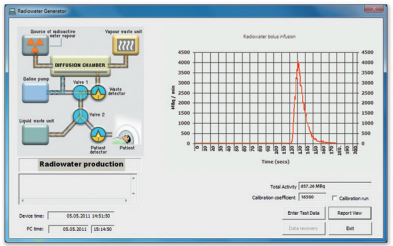
^{15}O labelled water vapour is mixed with physiological saline to create radiowater. Mixing is done in the diffusion chamber mounted in the lead shield to decrease staff exposure. The radiowater activity production level is continuously monitored. A separate detector records the activity infused to the patient.

Sterile disposable diffusion chamber kits

The diffusion chamber holds two filters, a hydrophobic and a hydrophilic membrane filter. The radioactive water vapour is inserted on the hydrophobic side and saline on the hydrophilic side. Between the two membranes the gas and liquid are mixed producing radiowater. The diffusion chamber sets are manufactured under strict quality regulations and they are CE-marked.

CONTROL UNIT AND OPERATION

The control unit has two PMT detectors equipped with multi-channel analyzers to separate positrons from background gamma radiation. The unit also has a keyboard to control the operations. Beside the control unit a laptop PC is used to record and calculate the activity data collected in the studies. The radiowater generator is currently in routine operation in several PET centres in Europe. The screenshot below shows actual water production runs.



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Advantages of the new system:

- *Disposable sterile components*
- *Remote controlled automatic i.v. injection*
- *Increased patient safety*
- *Decreased staff radiation exposure*

Additional equipment needed:

- **Saline pump providing a constant, pulseless saline flow (e.g. IVAC 571, or similar)**
- **Compressed air source, the pressure requirement is 4 – 5 bar**
- **Air conditioning system providing a negative pressure**
- **Source of radioactive water vapour**
- **Waste for radioactive gas**
- **Patient inlet canules**
- **Stopwatch**

Instrument features:

Main unit:	**Case of steel plate**
Display:	**2 * 16 character LC display**
Keyboard:	**16 membrane type push buttons**
Light detector:	**Photomultiplier tube (PMT)**
Microcomputer:	**Based on Intel 80196 NU, 50 MHz clock**
MC memory:	**128 Kbytes EPROM, 64 Kbytes SRAM, 32 Kbytes of battery backed-up RAM**
Multi Channel Analyser:	**Based on 12 bit, 700 ns ADC and digital signal processing**
Data output:	**RS-232 C serial output interface, 9 pin D connector. Format: No parity, 8 bits, 1 stop bit, 9600 baud. The format is not changeable**
PMT bias supply:	**Microcomputer controlled, 800 ... 1250 V**
Power input:	**12 V ± 20% DC, 4.5 A**
External Power unit:	**230/115V AC to 12V DC, 9A, medical certification**
Performance:	**Dose range 100 MBq – 2 GBq, detector accuracy +/- 15%**

Before use, the system must be officially validated by appropriate authorities according to the laws of the countries involved. The operator is responsible for meeting all the necessary validation requirements.

The system does not conform to the EU CE directive of medical devices.

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