



Instrumental Presentation

Electron Capture Detector

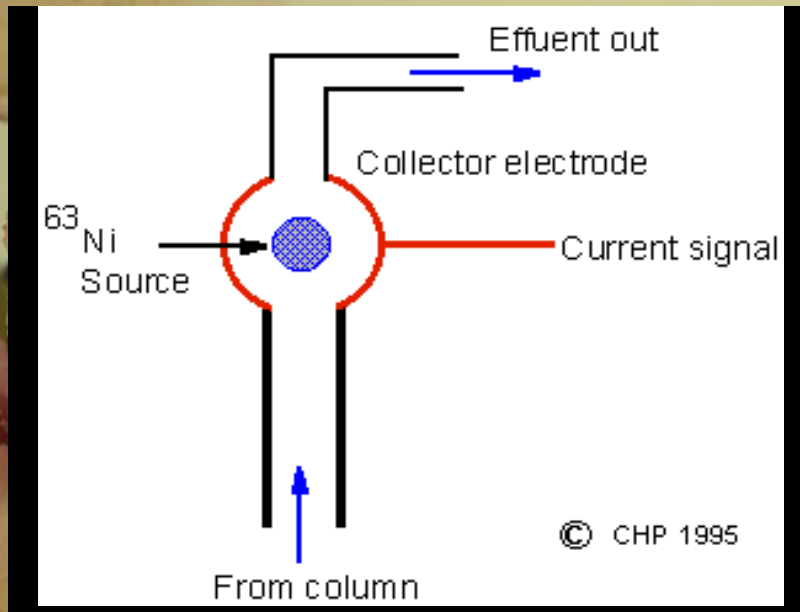
Indranath Chakraborty

26/11/2011

Introduction

- The Electron Capture Detector (ECD) is selective to electronegative compounds, especially chlorinated, fluorinated, or brominated molecules.
- It is sensitive to some of these compounds in the parts per trillion (ppt) range.
- It requires nitrogen or argon / 5% methane (P5) to operate.
- It consists of a stainless steel cylinder containing 5 millicuries of radioactive Nickel 63 in an oven enclosure that is thermostatically controllable from ambient temperature to 375°C

Electron Capture Detector



Working Mechanism

ECD detects ions in the exiting from the gas chromatographic column by the anode electrode.

^3H or ^{63}Ni which emits β particles.

Ionization : N_2 (Nitrogen carrier gas) + β (e) = N_2^+ + 2e

These N_2^+ establish a “base line”

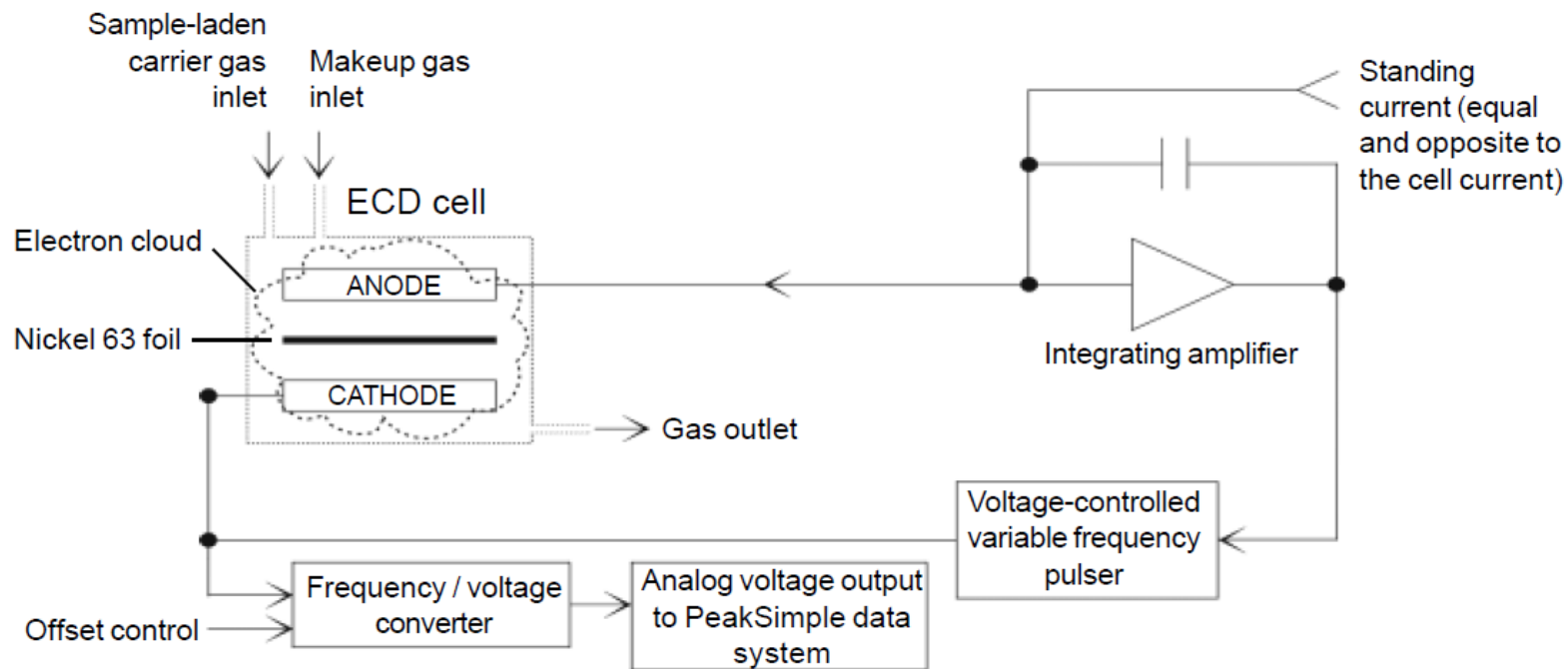
X (F, Cl and Br) containing sample + β (e) \rightarrow X^-

Ion recombination : $\text{X}^- + \text{N}_2^+ = \text{X} + \text{N}_2$

The “base line” will decrease and this decrease constitutes the signal.

Insecticides, pesticides, vinyl chloride, and fluorocarbons

ECD Detector Operational Diagram



Example Pulse Trains



Detector electronics pulse to maintain the standing current



The pulse rate is increased in the presence of electronegative compounds

When the electron population is decreased, the pulse rate is increased to maintain a constant current equal to the standing current. The pulse rate is converted to an analog output, which is acquired by the PeakSimple data system. Unlike other detectors which measure an increase in signal response, the ECD detector electronics measure the pulse rate needed to maintain the standing current.

Pros and Cons

- It is more sensitive than FID and TCD detector.
- Sensitivity can be down to ppt level for CFC type molecule.
- It takes few hours time to get stability unlike FID.
- It is restricted for electron withdrawing material like halogenated molecules only in respect of sensitivity.



Thank you