3.2 - Development of a New Enhanced Oil Recovery Process

The Water Imbibition Process - Dr. Perez and Dr. Poston

Brownscombe and Dyes[18] suggested that imbibition flooding could contribute to oil production from the Spraberry trend of West Texas in 1952 . This study established the following conditions for applying a successful imbibition flood: (1) the rock should be preferentially water-wet; (2) the rock surface exposed to imbibition should be as large as possible; and (3) a high oil saturation would greatly benefit the recovery process.

A typical imbibition curve is shown in Fig. 24. Note, most of the recovery is achieved in a rather short length of time. This is a little understood fact in imbibition waterflooding.

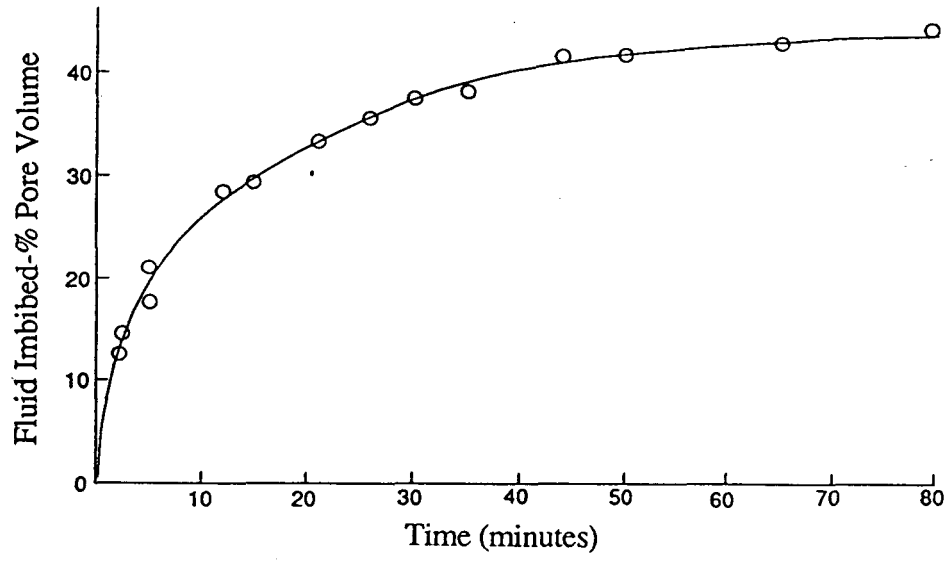

Fig 24 - A Typical Production Curve Resulting from the Imbibition Displacement

Graham and Richardson[19] also derived an equation that describes the imbibition process and defined a reservoir scaling term:

$$\sqrt{\frac{k}{\phi}}\,\frac{\sigma f(\theta)}{\mu_w}$$

This term reveals several facts:

- The oil production rate varies directly with the oil-water interfacial tension.
- The oil production rate is dependent upon the contact angle.
- The rate of imbibition is a function of the viscosity of oil and water.
- The rate of imbibition is a complicated function of the relative permeability and capillary pressure characteristics of the porous medium.