The considered model consists of conservation equations of mass for water phase and oil phase in porous medium in a cylindrical domain of height *h* and radius *r e (re>>h)* with a well at the axis of the cylinder (radius of the well). Because it is assumed that the flow in radial symmetry and the gravity effect is negligible, to solve the problem the domain can be reduced
to the interval I =[*, re*] and the equations in radial coordinates is reduced to:

where:

* The porous medium is assumed as fully saturated and the percentage of fluid inside the pores is given by the saturation of the two fluids

 

* Since it is assumed that the capillary pressure (*pc* ) is equal to zero

 

* The velocity is expressed by Darcy Law

 

* Relative permeability is expressed according to the Corey relationship:

 

 

* It is assumed that the fluids and porous medium are slightly compressible so it is possible to express the porosity of the medium and formation volume factor of the fluids according to these relationships

 

 

where  and are values related to the pressure .

Assumptions made by the equations can be rewritten over the pair of variables 

 And substituting the expressions

Then in the notation used in COMSOL will be:

 

As for the initial conditions, a constant value was imposed throughout the domain for both equations:

Since it is assumed that we want to inject a certain constant flow of water , we impose a Neumann condition on board  on the pressure:

In language of COMSOL we write such

Finally, it is assumed that the outer boundary is impermeable, so the conditions will be imposed “no flow” for *x=re*