The diffusion equation for the concentration, , in radial coordinates reads

We discretize space and time using

We denote .

The finite difference approximations for the derivatives are

The discretized differential equation is therefore

We define and rewrite the equation as

time

space

We use the initial condition

We use the Neumann boundary condition

Which means that the concentration gradient is 0 at the origin ().

Lastly, we set

And with this normalization

Combining this with the discretized difference equation we get

We set up the vector equation

Or in vector/matrix notation:

We need to solve for the unknown vector

After solving for all the entries in the first element, , is equal to the second element, , and the last element is found from:

We now add to the diffusion equation a decay term

This gives the following discretized difference equation

Define and we get

Now the concentration is not fixed, but rather decays with time. We modify the boundary condition

With this we now have

This changes the vector to

And adds to each diagonal entry of the matrix , the constant , e.g. .