Calculating the Mass Cellulose Prior to Acid Hydrolysis with Glucose

The mass of 1 mole of cellulose with a degree of polymerization *n* is:

$$M(n) = \left[\left(180.16\frac{g}{mol}\right)n - \left(18.02\frac{g}{mol}\right)(n-1)\right] * 1\,mol$$

After complete acid hydrolysis of that same mole of cellulose, the mass of glucose present is:

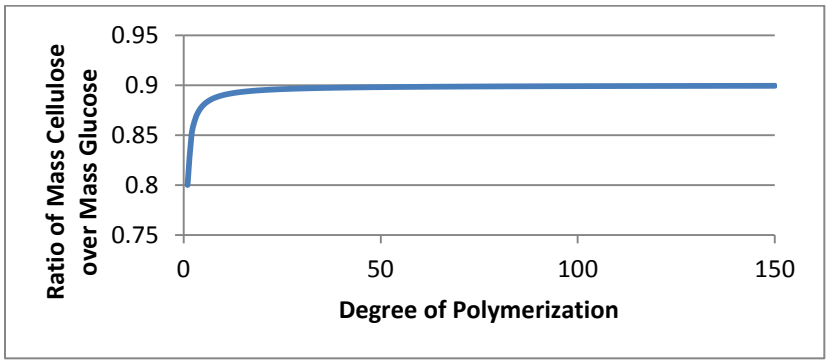
$$m(n) = \left(180.16\frac{g}{mol}\right) * n\,mol$$

The ratio of the mass of cellulose prior to hydrolysis to the mass of glucose present after hydrolysis is:

$$\frac{M(n)}{m(n)} = \frac{180.16n - 18.02(n-1)}{180.16n} = 1 - \frac{18.02}{180.16} - \frac{18.02}{180.16n} = 0.899978 - \frac{18.02}{180.16n}$$

As the degree of polymerization *n* becomes large, the mass ratio of cellulose prior to hydrolysis to glucose after hydrolysis approaches 0.899978:

$$\lim_{n\to\infty}\frac{M(n)}{m(n)} = \lim_{n\to\infty} 0.899978 - \frac{18.02}{180.16n} = 0.899978$$



Multiplying the total mass of glucose present after acid hydrolysis by 0.898 or 0.899 is a good approximation of the mass cellulose prior to hydrolysis.