

Introduction:

Insulin promotes glucose metabolism and is required for the provision of energy to the body's cells. Diabetes mellitus, which is the third leading cause of mortality in industrialized nations after cardiovascular illnesses and cancer, is caused by impaired insulin production (Barfoed, 1987).

A 21-amino acid chain and a 30-amino acid chain make up each of the 51 amino acids that make up human insulin, which is a polypeptide. There are two disulfide bonds that join the A and B chains together. The isoelectric point of human insulin is 5.4 and its molecular weight is 5,734.

Process Description:

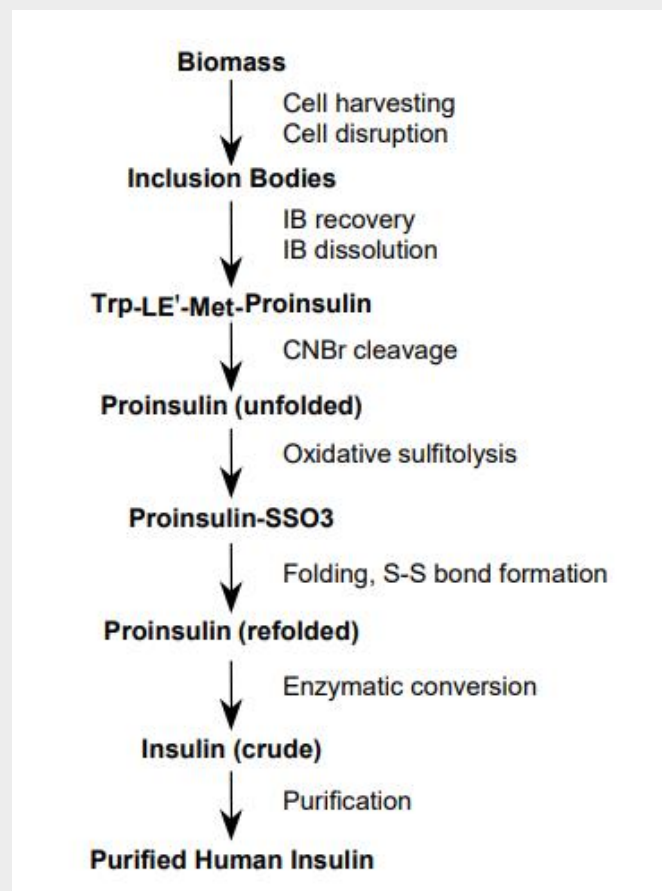


Table 11-11 Raw material requirements (1 batch = 11.31e kg MP)

| Raw Material | kg/Year | kg/Batch | kg/kg MP |
|------------------|--------------------|----------------|-----------------|
| Glucose | 782,238 | 4,889 | 432.2 |
| Salts | 71,428 | 446 | 39.5 |
| Air | 3,647,536 | 22,797 | 2,015.5 |
| Ammonia | 75,689 | 473 | 41.8 |
| Water | 27,798,131 | 173,738 | 15,360.6 |
| NaOH (0.5 M) | 5,548,731 | 34,680 | 3,066.1 |
| H3PO4 (20% w/w) | 6,451,713 | 40,323 | 3,565.1 |
| TRIS Base | 43,200 | 270 | 23.9 |
| WFI | 61,446,154 | 384,038 | 33,953.6 |
| EDTA | 10,427 | 65 | 5.8 |
| Triton-X-100 | 3,035 | 19 | 1.7 |
| CNBr | 15,268 | 95 | 8.4 |
| Formic acid | 1,751,525 | 10,947 | 967.9 |
| Urea | 3,062,697 | 19,142 | 1,692.4 |
| MrEtOH | 98,660 | 617 | 54.5 |
| NH4HCO3 | 5,551 | 35 | 3.1 |
| Sodium sulfite | 48,318 | 302 | 26.7 |
| Na2O6S4 | 24,159 | 151 | 13.4 |
| Guanidine HCl | 805,593 | 5,035 | 445.2 |
| Sodium Chloride | 778,032 | 4,863 | 429.9 |
| Sodium Hydroxide | 137,678 | 860 | 76.1 |
| Acetic-Acid | 2,435,170 | 15,220 | 1,345.6 |
| Enzymes | 3 | 0 | 0.0 |
| Acetonitrile | 767,190 | 4,795 | 423.9 |
| Ammonium Acetate | 181 | 1 | 0.1 |
| Zinc Chloride | 320 | 2 | 0.2 |
| Total | 115,808,631 | 723,804 | 63,993.0 |

Reference:

[1] R. G. Harrison, P. W. Todd, S. R. Rudge, and D. P. Petrides, "Bioprocess Design and Economics," in *Bioseparations Science and Engineering*, London, England: Oxford University Press, 2015.

