

Toluene nitration

The diagram illustrates the Toluene nitration process. It begins with the input of Toluene (1-01) and $\text{HNO}_3(\text{aq})$ (1-02) into mixer M101. The mixture then passes through a heat exchanger H101 (1-03) and enters mixer M102. The output of M102 (1-12) goes to reactor R101. The reactor effluent (1-05) is then processed by separator S101, which splits into two streams: 1-06 and 1-09. Stream 1-06 goes to separator S102, which produces a top product (1-08) and a bottom stream (1-07). Stream 1-09 goes to separator S103, which produces a top product (1-10) and a bottom stream (1-04). Stream 1-04 is recycled back to mixer M101. The bottom stream from S102 (1-07) enters separator S201, which produces a top product (2-04) and a bottom stream (2-01). Stream 2-01 enters separator S202, which produces a top product (2-03) labeled 'Waste (l)' and a bottom stream (2-02) that is recycled back to mixer M101.

2-nitrotoluene reduction

The diagram illustrates the 2-nitrotoluene reduction process. It starts with two feed streams: propanol (2-15) and H₂ (2-11). Propanol is pumped (P201) and mixed (M201) with 2-nitrotoluene. H₂ is pumped (P202) and mixed (M202) with 2-nitrotoluene. Both streams are preheated by heat exchangers H201 and H202 before entering the adiabatic reactor R201. The reactor effluent (2-08) goes to a separator V-201. The top product (2-09) is sent to storage tank S602, which has two waste outlets (6-06, 6-07). The bottom product (2-10) goes to storage tank S603, which has two waste outlets (6-03, 6-04) and one product outlet (6-02) labeled o-toluidine.

4-nitrotoluene oxidation

The diagram illustrates the process flow for 4-nitrotoluene oxidation. The process begins with raw material 2-02, which is pumped by SC301 through heat exchanger H301 and pump P301 to heat exchanger H302. Air is introduced into the process at stream 3-23, passing through pump P302 and heat exchanger H303. The main reaction stream (3-01 to 3-02) and the air stream (3-24 to 3-25) are mixed and then pass through two reactors, R301 and R302, which are equipped with internal heating coils. The effluent from R301 (3-04 to 3-05) and the effluent from R302 (3-07 to 3-08) are combined in separator S301. The top product stream (3-06) is sent to Waste (g) (3-22). The bottom stream (3-09) is sent to separator S302. The effluent from S302 (3-10) is sent to separator S303. The top product stream (3-11) is sent to Waste (l) (3-15). The bottom stream (3-12) is sent to Waste (l) (3-18). The final product stream (3-16) is sent to PNT (3-17).

4-nitrobenzoic acid reduction

Formic acid

3-13

3-21

3-14

H303

3-20

3-19

R401

4-01

S401

4-04

4-03

4-02a

SC401

4-02

ABA

Waste (l)

CO₂ + O₂

R302

4-nitrobenzaldehyde reduction