

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 reactor R101. The reactor output (1-05) goes to separator S101, which splits into two streams: 1-06 (top) and 1-09 (bottom). Stream 1-06 enters separator S102, which produces a top product stream (1-08) and a bottom stream (1-07). Stream 1-07 enters separator S201, which produces a top stream (2-04) and a bottom stream (2-01). Stream 2-01 enters separator S202, which produces a bottom stream (2-03) labeled 'Waste (l)' and a top stream (2-02) that is recycled back to the reactor R101. Additionally, a stream (1-10) from S102 goes to separator S103, which produces a bottom stream (1-09) that is recycled back to the reactor R101 and a top stream (1-12) that is recycled back to mixer M101. A final stream (1-04) from H101 is also recycled back to mixer M101.

2-nitrotoluene reduction

The diagram illustrates the 2-nitrotoluene reduction process. It begins with two feed streams: propanol (stream 2-15) and H₂ (stream 2-11). Propanol is mixed with a recycle stream (2-14) in mixer M201. The mixture (2-05) is pumped by P201 to a heat exchanger H201. H₂ is compressed by P202 and mixed with a recycle stream (2-10) in mixer M202. The H₂ mixture (2-13) is then heated in H202 and enters reactor R201. The cooled effluent (2-07) from R201 is preheated in H201 before entering separator S602. The top product of S602 is waste (v) (stream 6-06), and the bottom product is waste (l) (stream 6-07). The bottom product of S602 is pumped by S603 to a second separator. The top product of this separator is o-toluidine (stream 6-02), and the bottom product is waste (l) (stream 6-05). The waste (l) stream (6-05) is pumped by S604 to a final separator, which produces waste (l) (stream 6-04) and a recycle stream (2-14) that is fed back to mixer M201.

4-nitrotoluene oxidation

The diagram illustrates the 4-nitrotoluene oxidation process. It begins with the feed stream 2-02, which is compressed by SC301 and then heated by H301. The resulting stream 3-01 is pumped by P301 and heated by H302 before entering reactor R301. A second reactor, R302, receives a feed from P302 (stream 3-07) and a stream from H303 (stream 3-24). The output of R302 (stream 3-08) is pumped by S302 into separator S301. The top product of S301 is stream 3-22, labeled 'Waste (g)'. The bottom product of S301 is pumped by S303 into separator S302. The top product of S302 is stream 3-16, labeled 'PNT', and the bottom product is stream 3-11, labeled 'Waste (l)'. A stream (3-15) is also labeled 'Waste (l)'. The diagram includes various process units like pumps, heaters, reactors, and separators, connected by pipes with stream numbers.

4-nitrobenzoic acid reduction

Formic acid (3-13) is fed into a reactor (R401) along with 4-nitrobenzoic acid (3-19). The reactor output (3-20) goes to a separator (S401). The separator output (4-01) goes to a scrubber (SC401). The scrubber output (4-02) is ABA. The waste stream (4-03) is labeled 'Waste (I)'.

4-nitrobenzaldehyde reduction

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graph LR
    In[3-12] --> R501[R501]
    R501 -- 5-01 --> S501[S501]
    S501 -- 5-07 --> Waste1[Waste (v)]
    S501 -- 5-02 --> S502[S502]
    S502 -- 5-03 --> S503[S503]
    S502 -- 5-06 --> PNBH[PNBH]
    S503 -- 5-05 --> Waste2[Waste (v)]
    S503 -- 5-04 --> ABH[ABH]
  
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