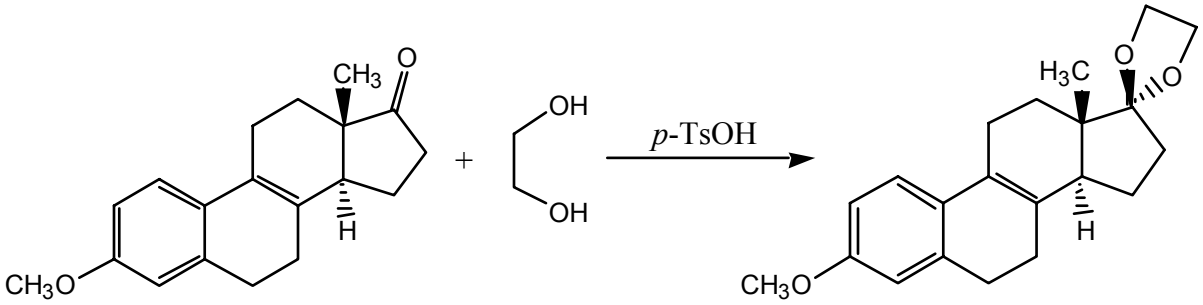
STEP 4:

3-METHOXY-1,3,5(10),8(9)-ESTRATETRAENE-17-ETHYLENE KETAL



1. Procedure

In a 100-mL, three-necked, round-bottomed flask equipped with a stirbar, prepare a solution (~ 0.1 M) of the starting material, 3-methoxy-1,3,5(10),8(9)-estratetraene-17-one, in dry toluene. Add a catalytic amount of *p*-toluenesulfonic acid (0.2 equiv) and an excess of ethylene glycol (10 equiv). Attach the flask to a Dean-Stark trap topped by a reflux condenser (Figure 4). Heat the reaction solution to reflux using a heating mantle or an oil bath as a heat source (notes 1 and 2). Monitor the reaction by TLC. Discontinue heating when the reaction is complete and allow the reaction solution to cool to room temperature. Record the amount of water collected in the Dean-Stark trap.

Wash the cooled reaction mixture sequentially with small portions of saturated aqueous sodium bicarbonate solution (2x) and distilled water (2x). Dry the organic layer over sodium sulfate, filter, and evaporate the solvent (note 3) on the rotary evaporator or under vacuum. (Use a dry ice or liquid nitrogen-cooled solvent trap between the vacuum line and the product solution.) The resulting oily product may solidify under vacuum. Purify the crude reaction product via column chromatography.

2. Notes

1. **Never plug a heating mantle or an oil bath into wall socket.** They must be connected to a **Variac** to regulate the voltage. Never heat an empty heating mantle. Always inspect the bottom of an oil bath for water droplets. Water in an oil bath may explosively vaporize and spray hot oil when the bath is heated near or above 100 °C.

2. The reflux must be vigorous enough for solvent to drip into and fill the Dean-Stark trap. The sidearms of the reaction flask and the arm from the flask to the condenser can be insulated with cotton and foil to facilitate this.

3. Toluene is both toxic and flammable. Avoid breathing the fumes. Dispose of the waste solvent in the solvent waste container. Never pour organic waste in the sink.

3. Characterization and Report

Determine the yield of product.

If the product has crystallized, determine its melting point.

Characterize the product(s) by IR and ^{1}H and ^{1}C NMR.

Tabulate and assign the spectral data.

List the TLC conditions used and the R_f values of starting material and product.

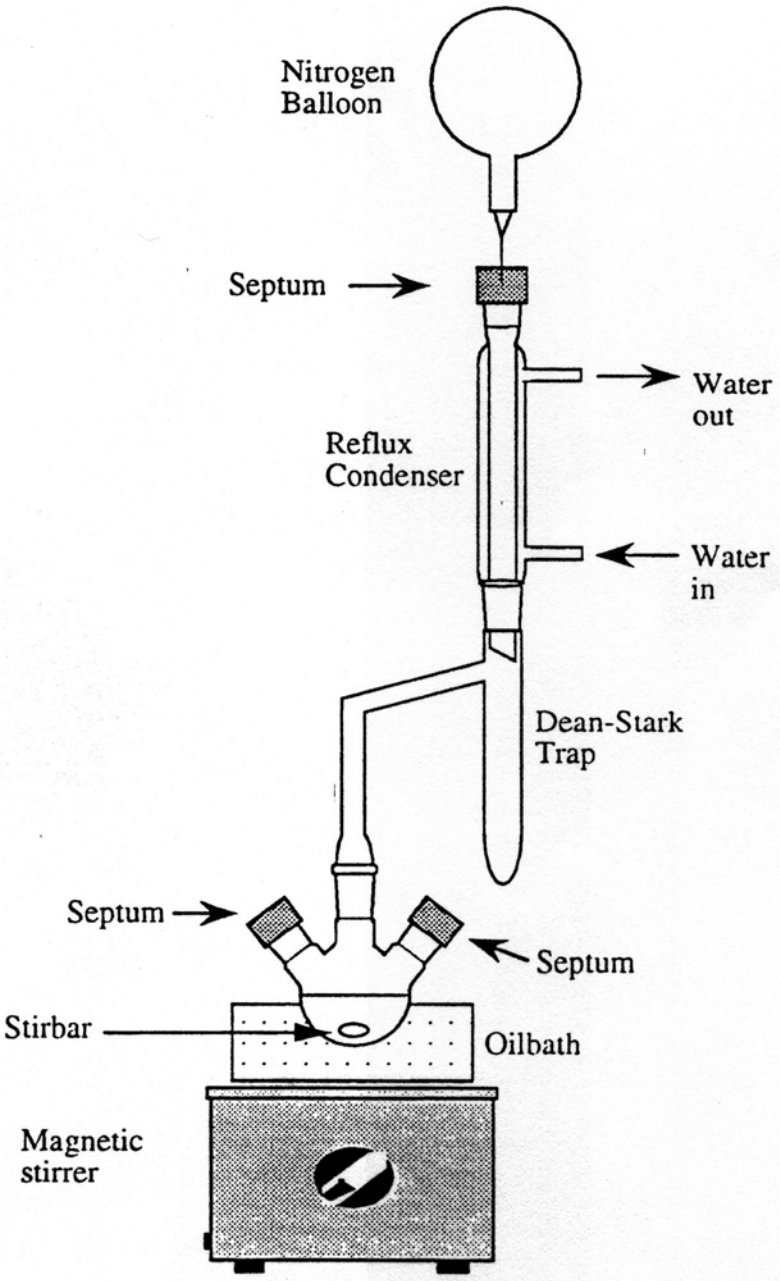


Figure 4. Refluxing Apparatus with Dean-Stark Trap