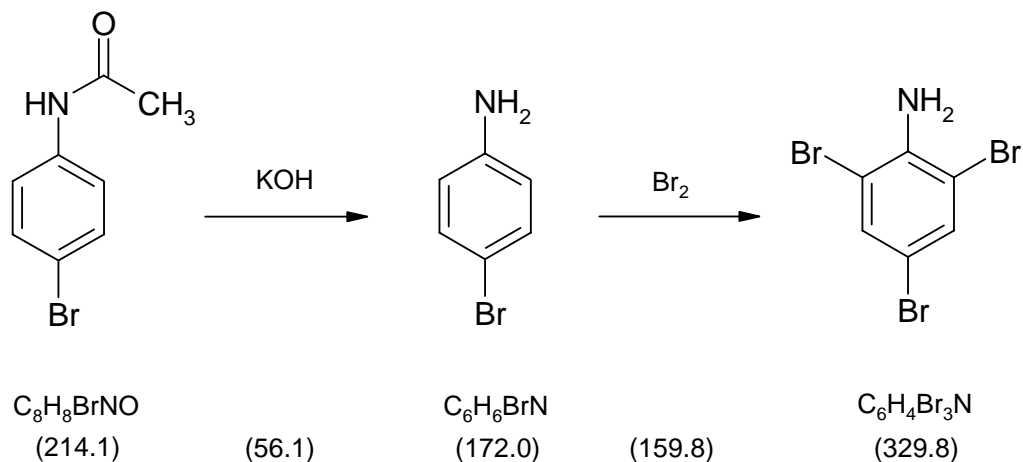


1007 Synthesis of 2,4,6-tribromoaniline from 4-bromoacetanilide**Classification****Reaction types and substance classes**

elektrophilic substitution of aromatics, bromination
aromatics, bromoaromatics

Work methods

stirring with magnetic stir bar, heating under reflux, adding dropwise with an addition funnel, filtering, recrystallizing, use of an ice cooling bath, heating with oil bath

Instruction (batch scale 10 mmol)**Equipment**

250 mL three-neck flask, reflux condenser, addition funnel with pressure balance, heatable magnetic stirrer, magnetic stir bar, internal thermometer, 400 mL beaker, Buechner funnel, suction flask, ice bath, oil bath

Substances

4-bromoacetanilide (mp 164-167 °C)	2.14 g (10.0 mmol)
bromine (bp 58.8 °C)	4.3 g (1.4 mL, 27 mmol)
ethanol (bp 78 °C)	about 50 mL
potassium hydroxide	2.1 g (37 mmol)
acetic acid (bp 118 °C)	about 24 mL
sodium disulfite	
potassium hydroxide for drying	

Reaction

2.14 g (10.0 mmol) 4-bromoacetanilid are dissolved in 7 mL ethanol under stirring and slightly heating in a 250 mL three-neck flask equipped with magnetic stir bar, reflux condenser and addition funnel with pressure balance. A solution of 2.1 g (37 mmol) potassium hydroxide in 4 mL water is added and the mixture is heated for 2.5 hours under reflux.

The mixture is allowed to cool down. About 17 mL acetic acid are added slowly until clear acidic reaction (pH5), then it is cooled in an ice bath. The flask is equipped with an internal thermometer and through an addition funnel a solution of 1.4 mL (27 mmol) bromine in 4 mL acetic acid is added dropwise very slowly within 45 minutes whilst stirring and further cooling. The internal temperature should be kept around 10 °C. After removing the ice bath the solution is stirred for further 15 minutes.

Work up

The reaction mixture is poured in a 400 mL beaker containing 70 mL ice water. The product precipitates as light brown solid. If the mixture is yellowish instead, solid sodium disulfite is added until the colour disappears. The precipitation is sucked off over a Buechner funnel, repeatedly washed thoroughly with water, sucked off again and dried over KOH in the evacuated dessicator.

Crude yield 3.20 g; mp 117 °C

The crude product is recrystallized from about 40 mL ethanol and again dried over KOH in the desiccator until weight constancy.

Yield: 2.10 g (6.37 mmol, 64%); mp 118 °C, white needles

Waste management**Recycling**

The ethanol from the mother liquor of recrystallization is evaporated at the rotary evaporator, collected and redistilled.

Waste disposal

Waste	Disposal
aqueous filtrate	solvent water mixtures, containing halogen
residue from mother liquor	dissolve in little acetone, then: organic solvents, containing halogen

Time

5 hours, without time for drying and recrystallizing

Break

After pouring in ice water

Before recrystallizing

Degree of difficulty

Easy

Instruction (batch scale 250 mmol)

Equipment

2 L three-neck flask, reflux condenser, addition funnel with pressure balance, heatable magnetic stirrer, magnetic stir bar, internal thermometer, 3 L beaker, Buechner funnel, suction flask, ice bath, oil bath

Substances

4-bromoacetanilide (mp 164-167 °C)	53.5 g (0.250 mol)
bromine (bp 58.8 °C)	106 g (34 mL, 0.66 mol)
ethanol (bp 78 °C)	about 620 mL
potassium hydroxide	51 g (0.90 mol)
acetic acid (bp 118 °C)	500 mL
sodium disulfite	
potassium hydroxide for drying	

Reaction

53.5 g (0.250 mol) 4-bromoacetanilide are dissolved 170 mL ethanol under stirring and slightly heating in a 2 L three-neck flask equipped with magnetic stir bar, reflux condenser and addition funnel with pressure balance. A solution of 51 g (0.90 mol) potassium hydroxide in 80 mL water is added and the mixture heated for 2.5 hours under reflux.

The mixture is allowed to cool down. About 400 mL acetic acid is added slowly until clear acidic reaction (pH5), then it is cooled in an ice bath. The flask is equipped with an internal thermometer and through an addition funnel a solution of 34 mL (0.66 mmol) bromine in 100 mL acetic acid is added dropwise very slowly within 2 hours whilst stirring and further cooling. The internal temperature should be kept around 10 °C. After removing the ice bath it is stirred for 1 hour further.

Work up

The reaction mixture is poured in a 3 L beaker containing 1.7 L ice water. The product precipitates as a light brown solid. If the mixture is yellowish, solid sodium disulfite is added until the colour disappears. The precipitation is sucked off over a Buechner funnel and repeatedly washed thoroughly with water, sucked off again and dried over KOH in the evacuated desiccator.

Crude yield 83.1 g; mp 116 °C

The crude product is recrystallized from about 450 mL ethanol and dried again over KOH in the desiccator until weight constancy.

Yield: 63.8 g (194 mmol, 77%); mp 118 °C, yellowish needles

Waste management

Recycling

The ethanol from the mother liquor of recrystallization is evaporated at the rotary evaporator, collected and redistilled.

Waste disposal

Waste	Disposal
aqueous filtrate	solvent water mixtures, containing halogen
residue from mother liquor	dissolve in little acetone, then: organic solvents, containing halogen

Time

6-7 hours, without time for drying and recrystallizing

Break

After pouring in ice water

Before recrystallizing

Degree of difficulty

Medium

Analytcs**GC of the recrystallized product**

GC-conditions:

column: 5CB Low Blend/MS, length 25 m, internal diameter 0.32 mm, film 0.25 μm

inlet: injector temperature 210 $^{\circ}\text{C}$, splitinjection, injected volume 1 μL

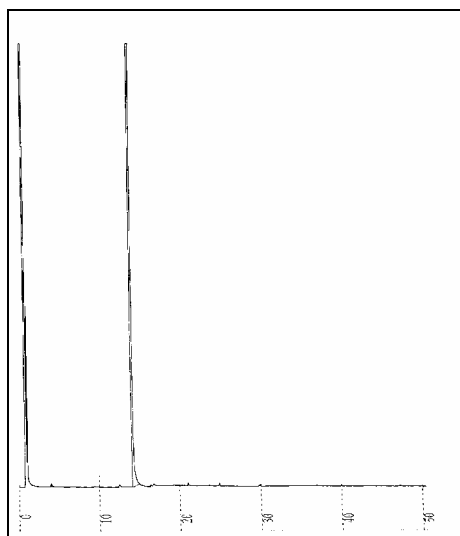
carrier gas: H_2 , pre-column pressure 50 kPa

oven: 60 $^{\circ}\text{C}$ (2 min), heating rate 5 $^{\circ}\text{C}/\text{min}$, isotherme 240 $^{\circ}\text{C}$ (30 min)

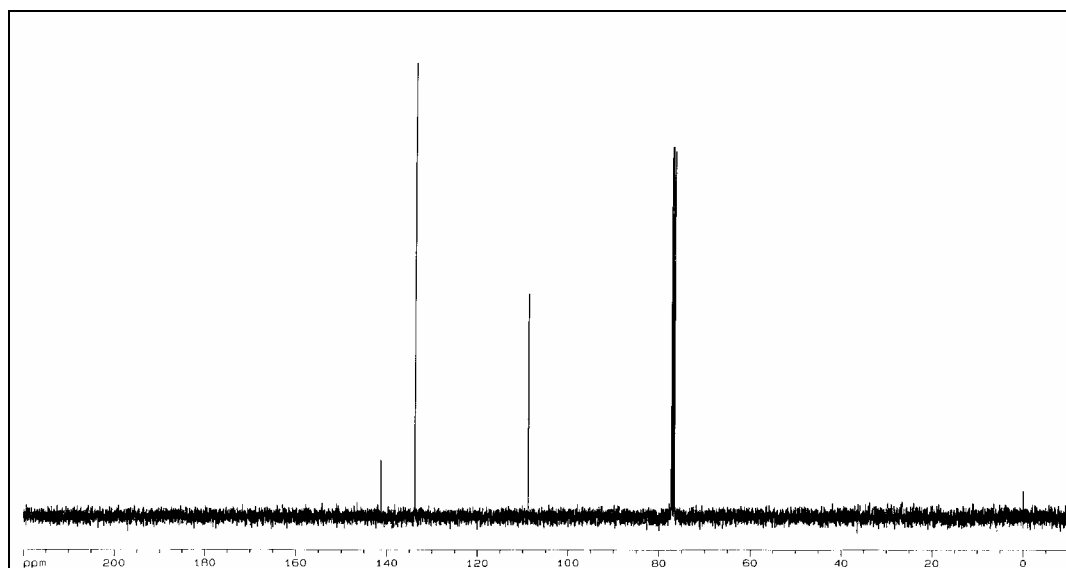
detector: FID, 310 $^{\circ}\text{C}$

integrator: Shimadzu

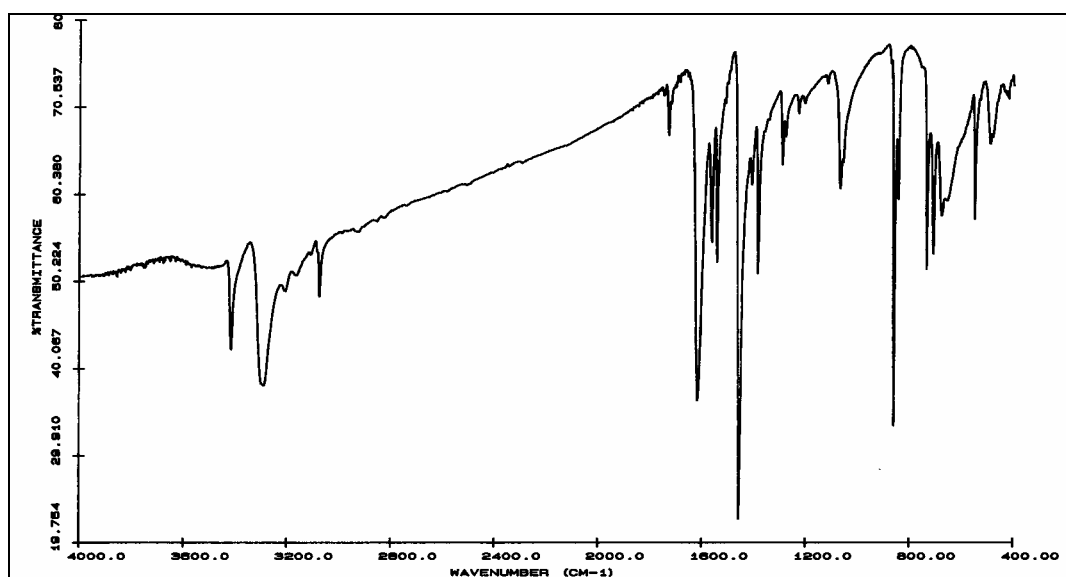
Percent concentration was calculated from peak areas.



Retention time(min)	Substance	peak area %
14.3	produkt (2,4,6-tribromoaniline)	99

^{13}C NMR spectrum of the pure product (400 MHz, CDCl_3)

δ (ppm)	Assignment
141.31	C-N
133.78	C-H
108.79	C-Br
76.5-77.5	solvent

IR spectrum of the pure product (KBr)

(cm^{-1})	Assignment
3415, 3290	N-H-valence, asymm. and symm.
3075	C-H-valence, arene
1615	N-H-deformation
1580	C=C-valence, arene