

CALCULATION OF 1 LITRE BOTTLE

Parameters

Moulding machine:	All types
Length/diameter of screw:	> 20d, recommended
Mould:	2 cavities, steel
Raw material:	HDPE
Bottle weight:	60 g
Cycle time:	23 s, without foaming
Raw material price:	0,95 €/kg (1.30 €)
Foaming Agent:	PLASTRONFOAM C 55-TA-F
Foaming agent price:	5 €/kg
Pinch-off weight:	15 g
Pinch-off:	will be recycled

Results

Dosing foaming agent:	1 %
Weight of foamed bottle:	48 g
Cycle time of foamed bottle:	17 s
Processing costs: (Labour, maintenance, electricity etc.)	35 €/h
Annual running time:	5000 h

Auxiliary calculation for foamed bottles

Weight of foaming agent per bottle:	$60 \text{ g} \times 0,01 = 0,60 \text{ g}$
Weight of foaming agent for pinch-off:	$15 \text{ g} \times 0,01 = 0,15 \text{ g}$
Weight of foaming agent per bottle:	$0,60 \text{ g} + 0,15 \text{ g} = 0,75 \text{ g}$
Weight of virgin material for foamed bottle:	$48 \text{ g} - 0,75 \text{ g} = 47,25 \text{ g}$

Calculation raw material costs

Compact bottle:	weight of HDPE used x price of HDPE
Foamed bottle:	weight of HDPE used x price of HDPE + weight of FA x price of FA

FA = Foaming agent

Comparison production costs compact bottle against foamed bottle

	compact	foamed
Number of bottles per hour:	312	422
Annual production rate of bottles:	1.560.000	2.110.000
Manufacturing cost per bottle (35€/no. bottle)	0,1122 €	0,0829 €
Raw material costs per bottle:	0,057 €(0,078 €)	0,0486 €(0,0652 €)
Production cost per bottle:	0,1692 €(0,1902 €)	0,1315 €(0,1481 €)

Investments for the production of foamed bottles

It absolutely necessary to work with a regulated air pressure drop in the range of < 3 bars, that requires a precision control valve.

The price for one blow-moulding machine is about 500 €

It might be also necessary to use a blow nozzle with a smaller diameter; usually the nozzle will already be present. Otherwise, costs in the amount from 2000 to 2500 € will be expected

The maximum investment for this 1000 ml bottle could be: 3000 €

The above figures relate to the bottle with the accompanying drawing. For other bottles it might be necessary to work with an under-pressure in the mould to get it properly formed-out.

Savings / Improvements

	compact	foamed
Increase of manufacturing capacity:	0 %	35 %
Saving manufacturing costs:	0 € 0%	0,0377 € 22 %
Saving raw material costs:	0 € 0%	0,0084 € (0,0128 €) 14,7 % (16,4 %)
Saving production costs	0 € 0%	0,0461 € (0,0505 €) 27,2% (29,8 %)

Savings for 2.110.000 bottles (full capacity in 3-shift operation)

Manufacturing costs:	78070 €	≡	22 %
Raw material costs:	17724 €	≡	14,7 %
	27000 €	≡	16,4 %
Production costs:	95794 € *	≡	27,2 %
	105000 €	≡	29,8 %
Total savings including maximal investment:	92790 €	≡	26 %
	102000 €	≡	28,5 %

* without investment

With price increase up to 1,30 €/kg

Additionally savings

The blow pressure in the process of foamed bottles will be reduced from about 8 bars to < 3 bars; this creates a significant potential savings in electrical energy.

Saving of up to 3% of white colour by white dyeing

Technical advantages using foaming agents

- Elasticity improves
- Crack resistance improves
- Diffusion barrier against Oxygen increases → longer shelf life time up to 30%
- The surface is more handy = soft-touch effect
- Heat insulation improves

Technical disadvantages using foaming agents

- No transparent pieces possible
- Change of colour without counteracting (colour gets paler)
- Minor reduction of top load with same wall thicknesses
- Minor reduction of side load with same wall thicknesses

