Chemical Engineering Equipment Brochure

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Introduction

When designing a large-scale process, there are many different ways to solve the same problem. Because of this, there are varying types of machinery that have the same purpose (transporting, cooling, mixing, etc).

Each machine may have the same purpose, but their cost, efficiency, environmental impact, life span, safety level and more vary greatly. For example, one machine might be the most efficient at mixing two chemicals and is environmentally friendly, but it might be expensive and thus not practical. On the other hand, another machine may be cheap and fairly efficient, but is horrible for the environment and requires manual labor. Each machine has an environmental rating and a space rating between the numbers of -3 and +3. A negative rating connotes high energy usage/taking up a lot of space. A positive rating connotes a machine that is environmentally friendly/does not require a lot of space in the plant. Once you have chosen all your machines, add together each of their environmental and space ratings, respectively. If you can make each of the two values zero, it's a good sign that your plant is not harming the environment and is not unreasonably large.

As a chemical engineer, it is your job to choose equipment that is practical for what you want to build. This may mean paying a higher price for more environmentally friendly equipment, or using less expensive machinery in conjunction with manual labor. It's up to you!

Each section in this pamphlet describes different families of machinery. When designing your process, you may use as few or as many of the equipment from each section. Just keep in mind that the costs add up!

If you have an idea for a piece of equipment that you would like to design and use, but it is not in the pamphlet, just let us know! There are many different machines in the real world and having to customize a machine for a certain process is fairly common. Thus, if you would like to design equipment of your own, please bring your idea to a workshop leader and we can discuss it with you!

Mixers

Bath: Manually mix ingredients or use to catch solids/liquids from above

Cost	$4,000
Operation Time	30 mins
Environmental Rating	+3
Space	-1
Requires Manual Labor	Yes, + $1000

Ribbon Blender: can blend materials of similar size, shape and density, ideal for dry solids/powders and very thick liquids

Cost	$10,000
Operation Time	15 mins
Environmental Rating	+1
Space	-1
Requires Manual Labor	No

Paddle Mixer: specially designed to scoop, lift, and tumble in a gentle but thorough mixing action; ideal for mixing liquids

Cost	$20,000
Operation Time	10 mins
Environmental Rating	-1
Space	-1
Requires Manual Labor	No

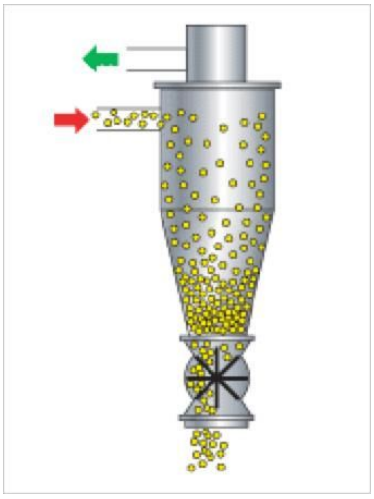
Separators

Settling Tank: fluid is pumped into a holding tank, where the larger particles settle out by gravity

Cost	$4,000
Operation Time	360 mins
Environmental Rating	+3
Space	-3
Requires Manual Labor	Yes, + $1000

Filter: passes solution over filter, larger particles/materials collected while water/fluids pass through

Cost	$20,000
Operation Time	60 mins
Environmental Rating	-3
Space	+2
Requires Manual Labor	No



Cyclone: separates large pieces of material from a liquid using a rotating fluid, large materials fall to bottom and liquid flows out of the top. Difficult to remove small particles.

Cost	$10,000
Operation Time	20 mins
Environmental Rating	+2
Space	+2
Requires Manual Labor	No

Extruders/Depositor

Multi-Pipetter: handheld release of solution

Cost	$10,000
Operation Time	120 mins
Environmental Rating	-3
Space	+2
Requires Manual Labor	Yes, + $1000

Rotary Valve Depositor: deposits soft and fluid material individually in round or oblong shape. The shape of the deposit can vary according to nozzle and speed.

Cost	$25,000
Operation Time	10 mins
Environmental Rating	+2
Space	+2
Requires Manual Labor	No

Regular Extruder: takes material and presses it through a die which shapes the material to the desired shape

Cost	$20,000
Operation Time	2 mins
Environmental Rating	+2
Space	-1
Requires Manual Labor	No

Cooling

Fan: blows on material, helps cool it down

Cost	$2,000
Operation Time	90 mins
Environmental Rating	-3
Space	+2
Requires Manual Labor	Yes, + $1000

Freezer/Cooler: cool or freeze material that is placed inside, store material for long periods of time

Cost	$10,000
Operation Time	30 mins
Environmental Rating	-2
Space	-1
Requires Manual Labor	Yes, + $1000

Pass-through Freezer/Cooler: cool or freeze material that passes through it

Cost	$25,000
Operation Time	15 mins
Environmental Rating	-3
Space	-3
Requires Manual Labor	No

Heating

Batch Oven: heat a batch of solution/material to a desired temperature

Cost	$10,000
Operation Time	30 mins
Environmental Rating	-2
Space	-1
Requires Manual Labor	Yes, + $1000

Continuous Oven: continuously heat a stream of solution to a desired temperature

Cost	$20,000
Operation Time	15 mins
Environmental Rating	-3
Space	-2
Requires Manual Labor	No

Transportation

Bin With Wheels: collect excess material or packaged material

Cost	$1,000
Operation Time	10 mins
Environmental Rating	+3
Space	+3
Requires Manual Labor	Yes, + $1000

Conveyor Belt: transport material

Cost	$5,000
Operation Time	1 min
Environmental Rating	-2
Space	-1
Requires Manual Labor	No

Bin: collect, move, and deposit material

Cost	$50
Operation Time	30 min
Environmental Rating	+3
Space	+3
Requires Manual Labor	Yes, + $1000

Storage

Vertical Storage Tank: store chemicals and other liquids; closed top protects contents

Cost	$1000
Operation Time	30 mins
Environmental Rating	+3
Space	-1
Requires Manual Labor	Yes, + $1000

Vertical Storage Tank with Pump: transport and store chemicals and other liquids; closed top protects contents, addition of pump allows for materials to easily be extracted or put in

Cost	$4000
Operation Time	5 mins
Environmental Rating	+1
Space	-1
Requires Manual Labor	No

Packaging

Cardboard/Boxes: Store/package material for shipping/handling, uniform

Cost	$2,000
Environmental Rating	+1
Space	+1
Does it protect the product?	Yes

Shrink Wrap: encases material in plastic wrap

Cost	$500
Environmental Rating	-3
Space	+2
Does it protect the product?	No

Glass: store/package material, easy to transport, but breaks easily

Cost	$3,000
Environmental Rating	+3
Space	-1
Does it protect the product?	Yes

<u>Fish Net Bags</u>: package material in small bunches, tears easily

Cost	$200
Environmental Rating	-3
Space	-3
Does it protect the product?	No

<u>Plastic Bags</u>: package material in small amounts, airtight so helps material stay fresh for longer

Cost	$500
Operation Time	1 min
Environmental Rating	-3
Space	-3
Does it protect the product?	No