Learning about the environment

Bauhaus - Universität Weimar

In co-operation with:

Assumption College Thonburi
KNOTEN WEIMAR GmbH
Prof. Dr. Kanoksak from Kasetsart University

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General Project Targets:

- Environmental education of the young generation – the students
- Waste utilisation:
  - By separate collection of recyclable waste,
  - Recycling and
  - Utilisation of organic waste directly on the school site

What is waste?

Definition 1: Perception of waste [Bidlingmaier]

Waste is perceived when it becomes a problem and asserts negative influence upon everyday life activities. In this case, waste is matter in the wrong place.

What is waste?

Definition 2: Subjective perception [Bidlingmaier et al]

With the application of subjective, respectively social value measurements, a product is declared to be waste not based on utilisation possibilities.

Only by the subjective judgement of the owner, the product turns into waste, when the owner proclaims it to be useless or of no value e. g. empty water bottles.

Waste Composition and Disposal at ACT

Waste Type	Amount [kg/week]
Hazardous waste	20,46
Tetra packs	35,51
Metals	41,95
Glass	131,18
Paper, cardboard	326,85
Fat	304,35
Material < 40 mm	535,55
Residual waste	831,05
Plastics	1.109,12
Garden waste	1.146,30
Kitchen waste	1.806,85
Sum	6.289,17

Waste Composition and Disposal at ACT

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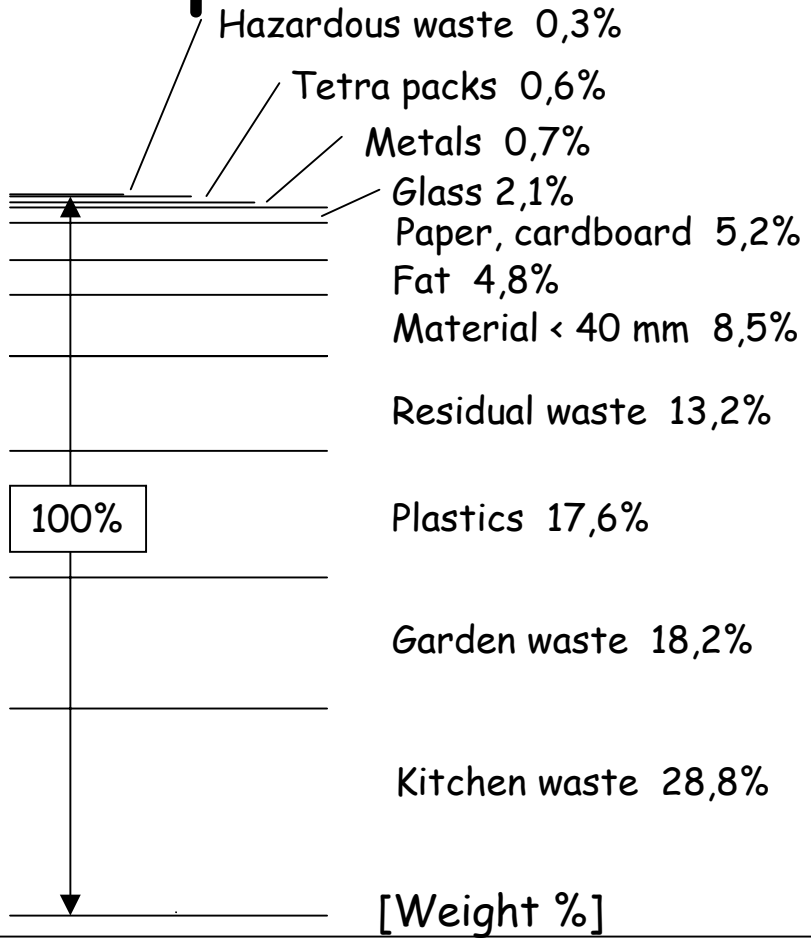
Waste Composition and Disposal at ACT



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Waste Composition and Disposal

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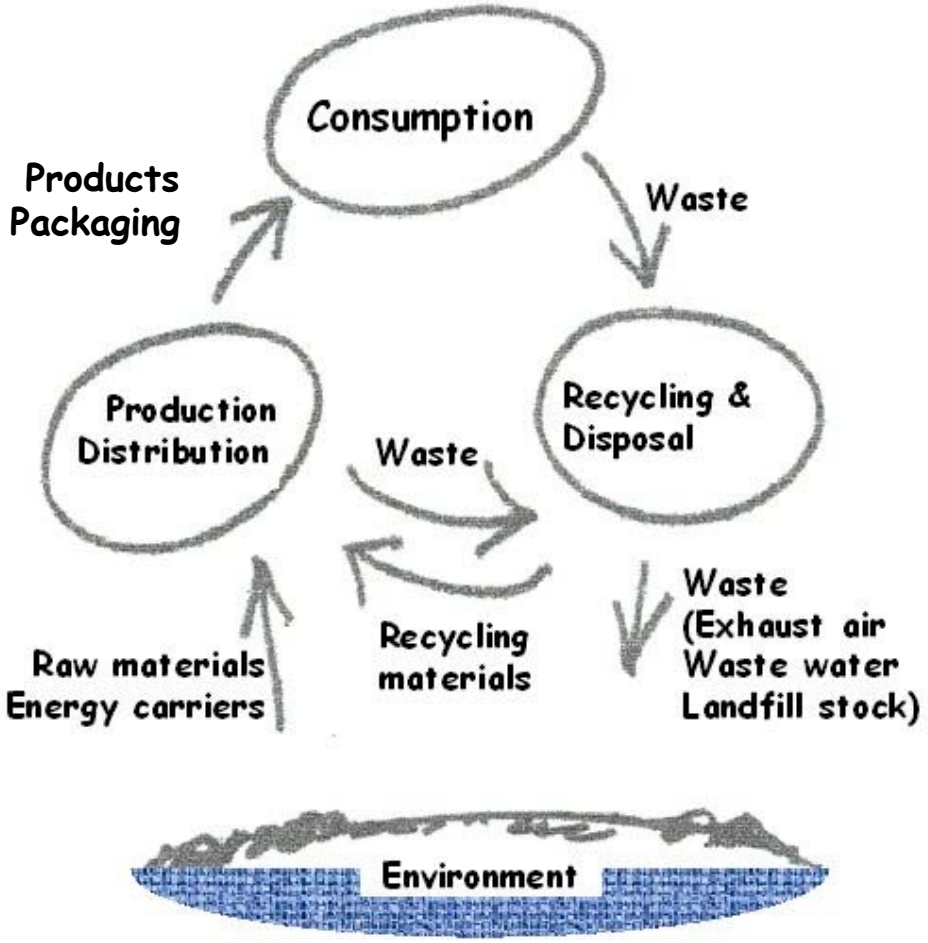
Waste Prevention

Formation and life cycle of products as well as

Recycling closed loop



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Waste Prevention

1. Waste prevention

2. Waste recycling

3. Appropriate waste treatment and disposal

Waste Prevention

Principles and possibilities for waste prevention, respectively waste reduction:

- When shopping take your own bag (backpack, etc.) with you
- Use reusable bottles in stead of plastic bottles

In the example of the canteen:
[Bidlingmaier et al]

- It is recommended to use reusable crockery and cutlery

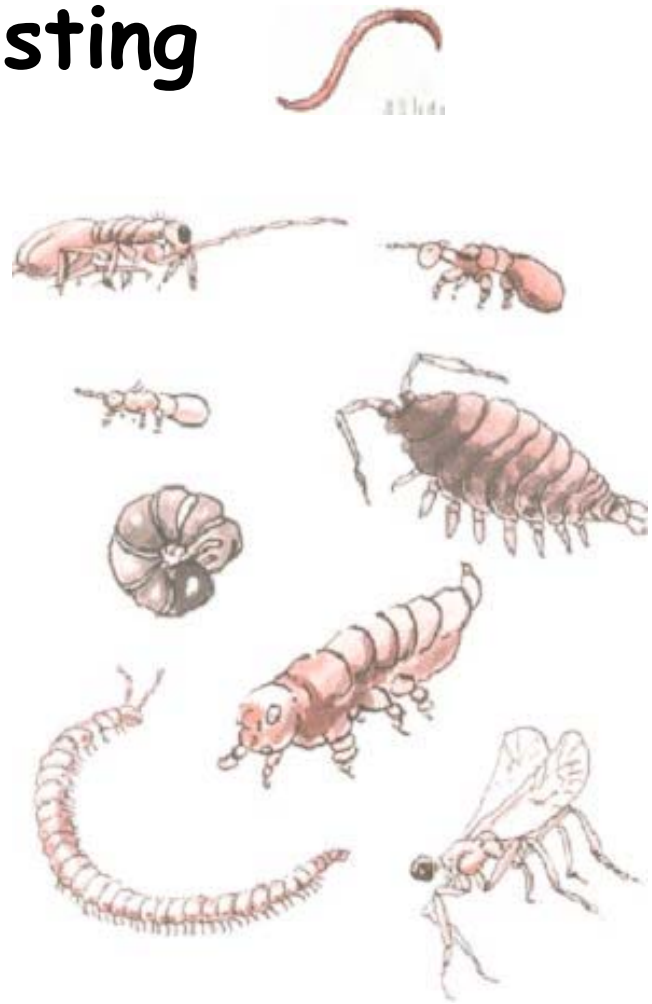
Basic Principles of Composting

- The tree absorbs nutrients from the soil for its own growth, fruit and leaves
- After some time the leaves fall onto the ground
- The „soil specialists" transform the leaves into crumbly and rich in nutrients soil
- The roots absorb the nutrients, the tree grows new leaves, blossoms and fruit [Dohmann, 1999].

Basic Principles of Composting

Numerous organisms take part in the composting process :

- Woodlice
- Earthworms
- Millipedes
- Flagellate
- Springtails (Collembola)
- Beetles
- Mites
- Bacteria
- Fungi



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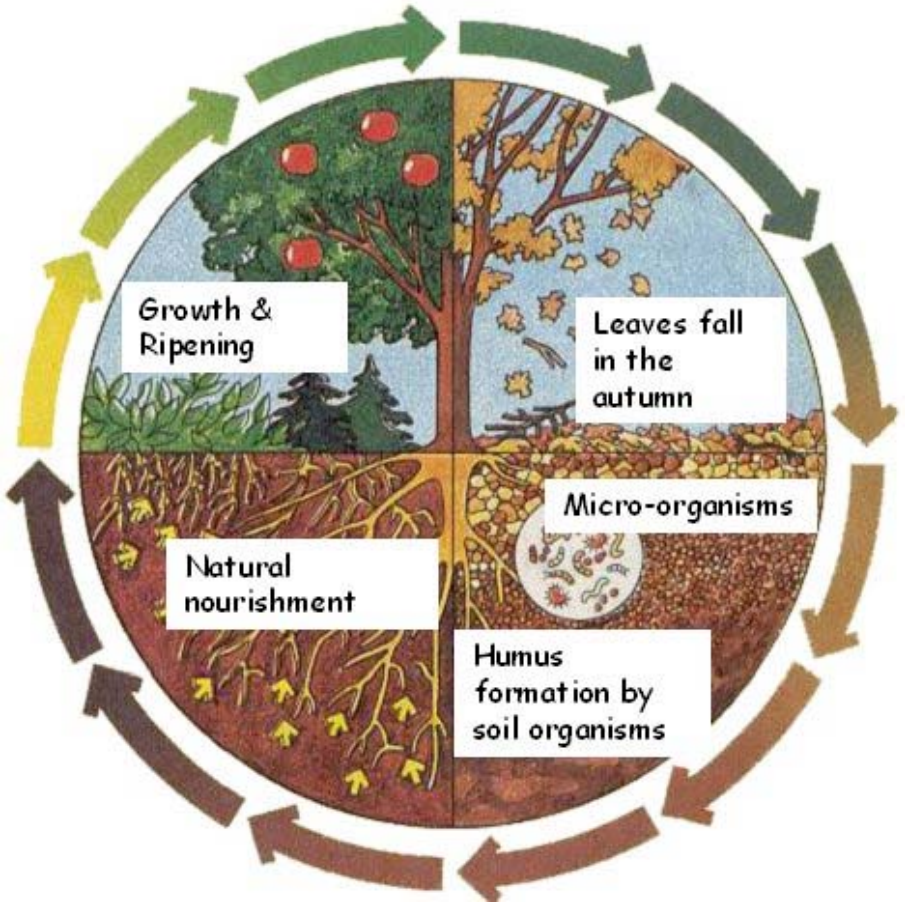
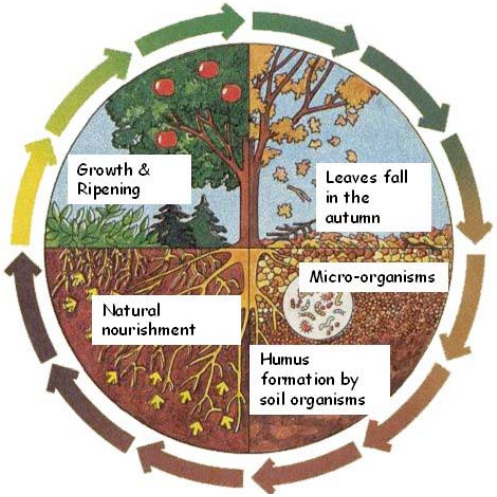
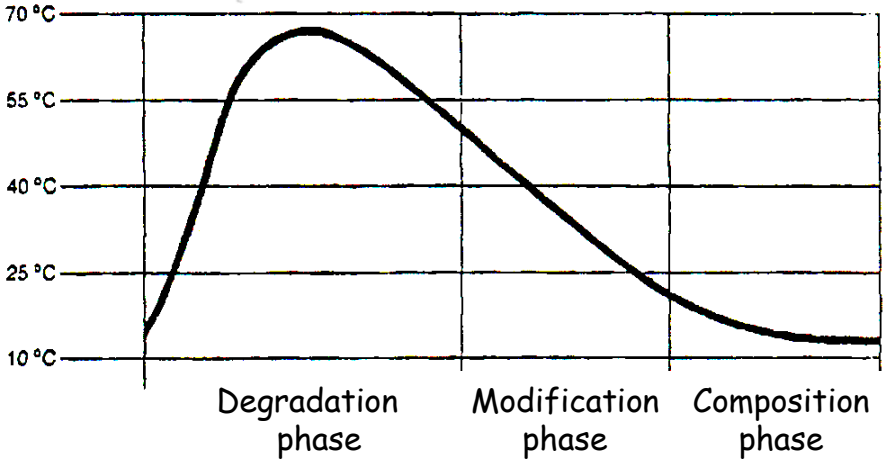


Basic Principles of Composting

- During the degradation of the composting material, the organisms generate heat, the temperature in the compost rises
- After the degradation, thermophile organisms e. g. fungi initiate humus decay and the temperature falls
- The composting process is characterised by a certain temperature course, see the figure [Bilitewski et al, 2000]
- This process is divided into three phases: **Degradation phase**, **Modification phase** and **Composition phase** [Bilitewski, 2000]





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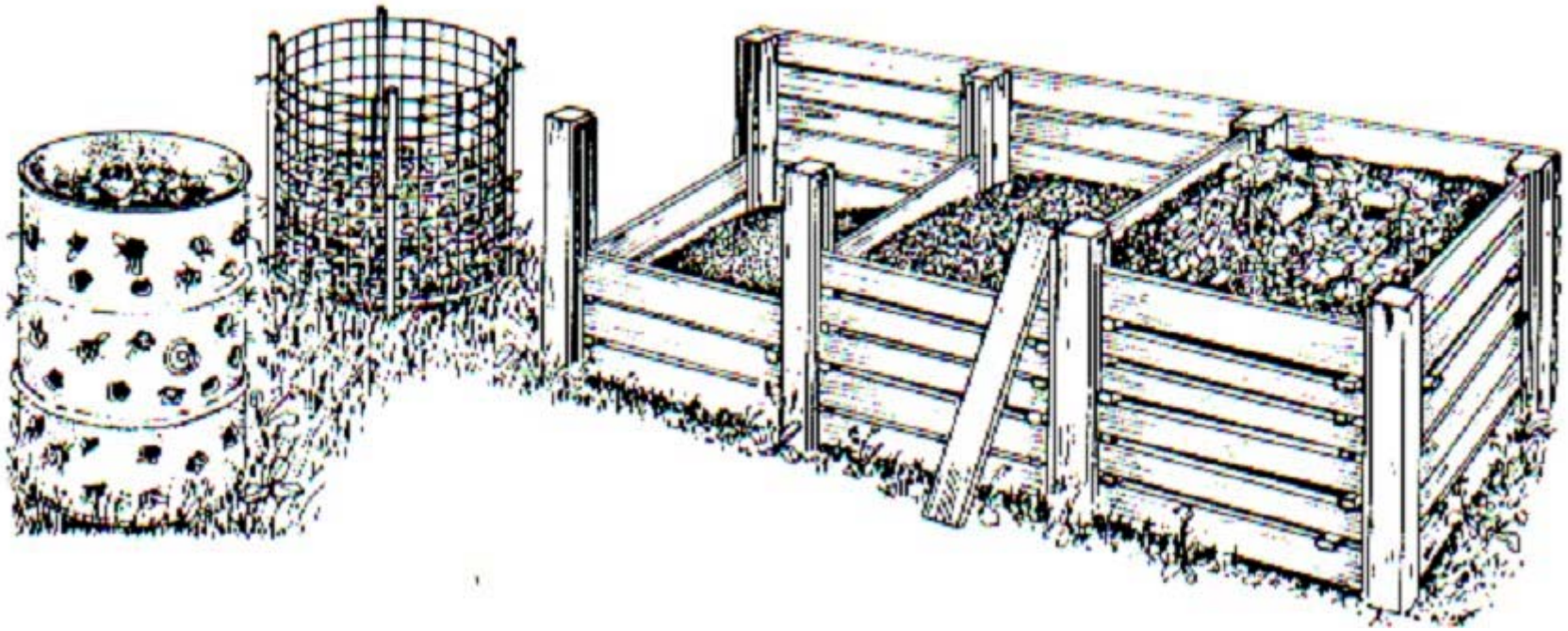
Basic Principles of Composting

Container possibilities for your own composting



Basic Principles of Composting

- Construct on grown soil, in order to obtain soil organisms in the compost
- Do not construct the compost site in pits and do not close it on all sides → Decay danger!
- The compost should be a mix of diverse materials, such as wood pieces, leaves, etc.
- Reduce to small pieces all large material particles
- Mix very well the different materials with one another
- Create a lower level of 20 cm from coarse materials, such as shrub cuttings; afterwards apply finer materials
- Waste, which attracts animals should be covered with soil
- Do not let the compost dry, as small organisms need moisture; do not wet it too much either, in order to avoid lack of air
- Cover the ready compost with leaves, soil or straw, to keep the heat and protect it from drying
- After certain period of time (~ 6 months in Europe) shovel the compost, in order to loosen the material and to stir it again

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Materials for Composting

Garden waste such as leaves, straw

Kitchen waste such as tee and coffee grounds

Egg shells

Vegetable rests

Fruit rests

Flower rests

Food rests

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Basic Knowledge of Paper

Qualities	Answer
What is the name of your paper?	
What is the colour of your paper?	
For what purpose can we use your paper?	
Touch the paper with your finger. Is the surface rough, smooth or shiny?	
Is your paper recycled or is it made from new fibres?	
Hold the paper at the corner and wave it. Does it rustle strongly, medium or slightly?	
Blow at the paper. Is it permeable to air or not?	
Hold the paper against the light. Is it translucent or not?	
Compare your paper with others. Is it thick, medium or thin?	
Hold the paper with one end in water. Does it absorb a lot or little water?	

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Production - New und Recycled Paper

1 kg new paper		1 kg recycled paper	
2,3 kg new wood			1,1 kg old paper
220 litres water !!!			20 litres water
7,4 kWh			0,8 kWh

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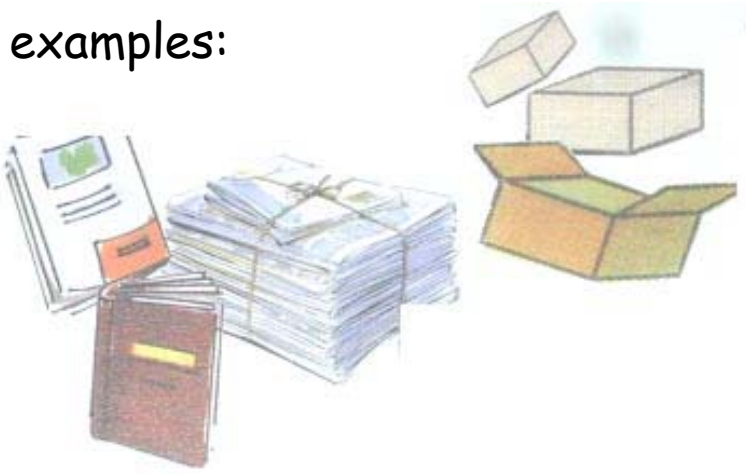
New and Recycled Paper

Further utilisation possibilities for old paper:

- Use of the fibre qualities for producing silages, chipboard, etc.
- Use of the thermal qualities – incineration for energy production
- Use of the biodegradability qualities for composting and production of fertilizers and compost

The following types can be used for these examples:

- newspapers and books,
- catalogues and magazines,
- writing, copying and printing paper,
- cardboard and paper packagings



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New and Recycled Paper

approx. 325 kg paper per week at ACT

If all the paper is disposed at a landfill site, it will be the equivalent of :

~ 32.500 A4 pages / week !

The landfill will become bigger and bigger every day.

If the paper is collected and recycled, raw materials such as water will be economised and you will have less waste!

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How to make our own paper?

1. Soaking the paper

Cut a Newspaper in small pieces

2. Making pulp

Reduce the paper pulp to small pieces by using a mixer

3. Diluting

Pour the paper pulp into a basin and dilute it

4. Dipping the sieve

Dip the sieve carefully into the paper pulp

5. Sieving

Pull up the sieve horizontally from the basin with a layer of paper pulp

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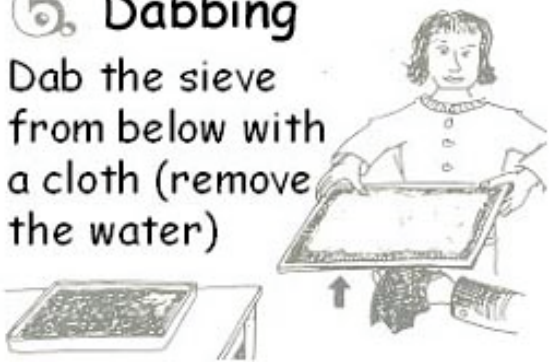
How to make our own paper?

6. Dabbing

Dab the sieve from below with a cloth (remove the water)



7. Turning over

Turn over the sieve onto a felt panel

8. Covering

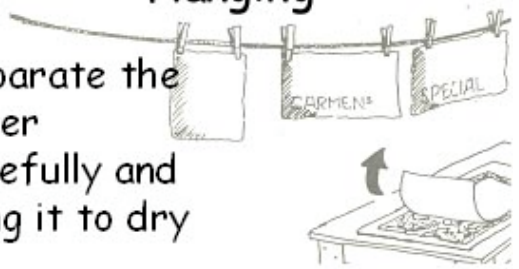
Cover the paper with a felt panel

9. Rolling & Drying

Roll the paper flat with a wooden rolling pin

10. Separating & Hanging

Separate the paper carefully and hang it to dry



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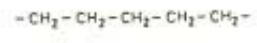
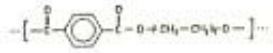
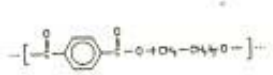
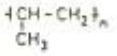
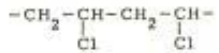
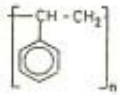
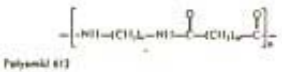
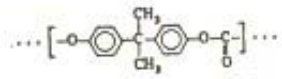
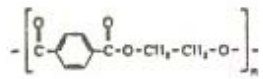
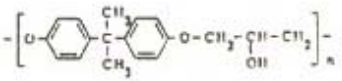
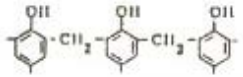
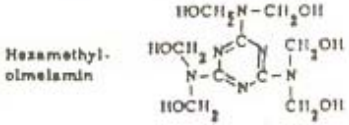
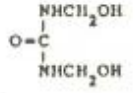
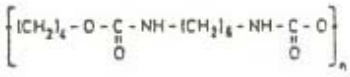
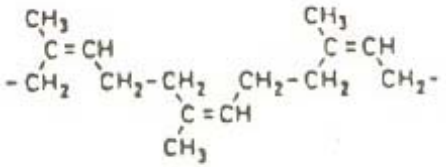
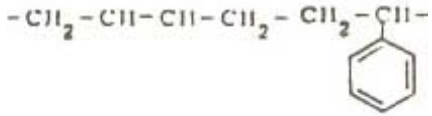
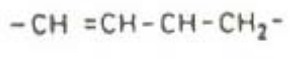
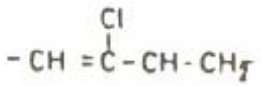
Background Knowledge of Plastics

Thermoplastics	Abbr.	Chemical formula	Application
Polyethylene	PE		Plastic films, moulded padding, bulk goods
Polyethylene terephthalate	PET		Wear resistant elements for fine mechanics, appliances castings, plastic films
Polybutylene terephthalate	PBT		Slide blaring, rollers, castings for spark plugs
Polypropylene	PP		Technical parts, e.g. for motor vehicles
Polyvinyl chloride	PVC		Films, window frames, pipes, cable isolation
Polystyrene	PS		Disposable cups, glassy household articles, injection moulded parts, styrofoam
Polyamide	PA		Cog wheals, pulp, wall dowels, electrical castings
Polycarbonate	PC		Compact discs, bead mouldings, bottles, ampullae

Background Knowledge of Plastics

Thermosetting plastics	Abbr.	Chemical formula	Application
Polyester	PE		Cast resin, varnish, spackle
Epoxy resin	ER		Varnish, cast resin, adhesives
Phenolic resin	PR		Electrical isolation materials, hardboard, cast & varnish resin, wood glue, car body parts
Melamine resin	MR		Binders for moulding materials, wood glue, varnish
Urea resin	UR	 	Binders for moulding materials, wood glue, varnish
Polyurethane	PR		Castables, foams, varnish

Background Knowledge of Plastics

Rubbers	Abbr.	Chemical formula	Application
Natural rubber	NR		Soft & hard rubber, hoses, gaskets
Styrene butadiene rubber	SBR		Car tires
Polybutadiene	PB		Car tires, linings, isolation materials
Polychloroprene	CR		Conveyer belts, cable coatings, foam rubber, protective clothing

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Recycling of Plastics

Mixed and contaminated plastic waste	Genuine plastic bottles	Genuine, slightly contaminated plastic cups
		

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Recycling of Plastics

Basic materials recycling	Raw materials recycling	Incineration
Description: When melted the thermo plastics can be reused (transformed) for the production of other products. The melting takes place at 150°C and 230°C.	Description: The polymeric materials are degraded into raw materials consisting of small molecules, i. e. the long-chain plastics are decomposed in short-chain raw materials. By this chemical transformation, the cycle: raw materials-plastics-raw materials is closed.	Description: The plastics are incinerated in incineration plants and utilised for energy production.

Recycling of Plastics

Basic materials recycling	Row materials recycling	Incineration
Advantages: Well utilisable in plastic processing companies, as the waste is sorted out according to the type.	Advantages: No sorting and cleaning are necessary. Acquisition of high quality plastics.	Advantages: Plastics have a high heat value.

Recycling of Plastics

Basic materials recycling	Row materials recycling	Incineration
Disadvantages: Sorting and cleaning are necessary for mixed waste. Eternal recycling is not possible as the process reaches a point in which the material deteriorates. Production of low quality products, which will have to be disposed of at a landfill site. Recycling, in order to produce high quality products, is currently not economically sustainable.	Disadvantages: High costs are required for energy and equipment, which can be seldom justifiable. Not all plastics can be recycled in this way.	Disadvantages: It is sustainable only in the cases, which involve the application of energy-intensive methods for the separation and sorting of plastics waste. Hazardous substances are discharged during the incineration process, which can be filtered but still need to be disposed.

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Waste has a value!

Waste Type	Amount [kg/week]	50 % of the amount [kg]	Thickness [mg/m³]	Volume [m³]
Paper, cardboard	326, 85		0,25	
Plastics	1.109,12		0,03	
Garden waste	1.146,30		0,11	
Kitchen waste	1.806,85		0,80	
Sum	4.389,12		-	

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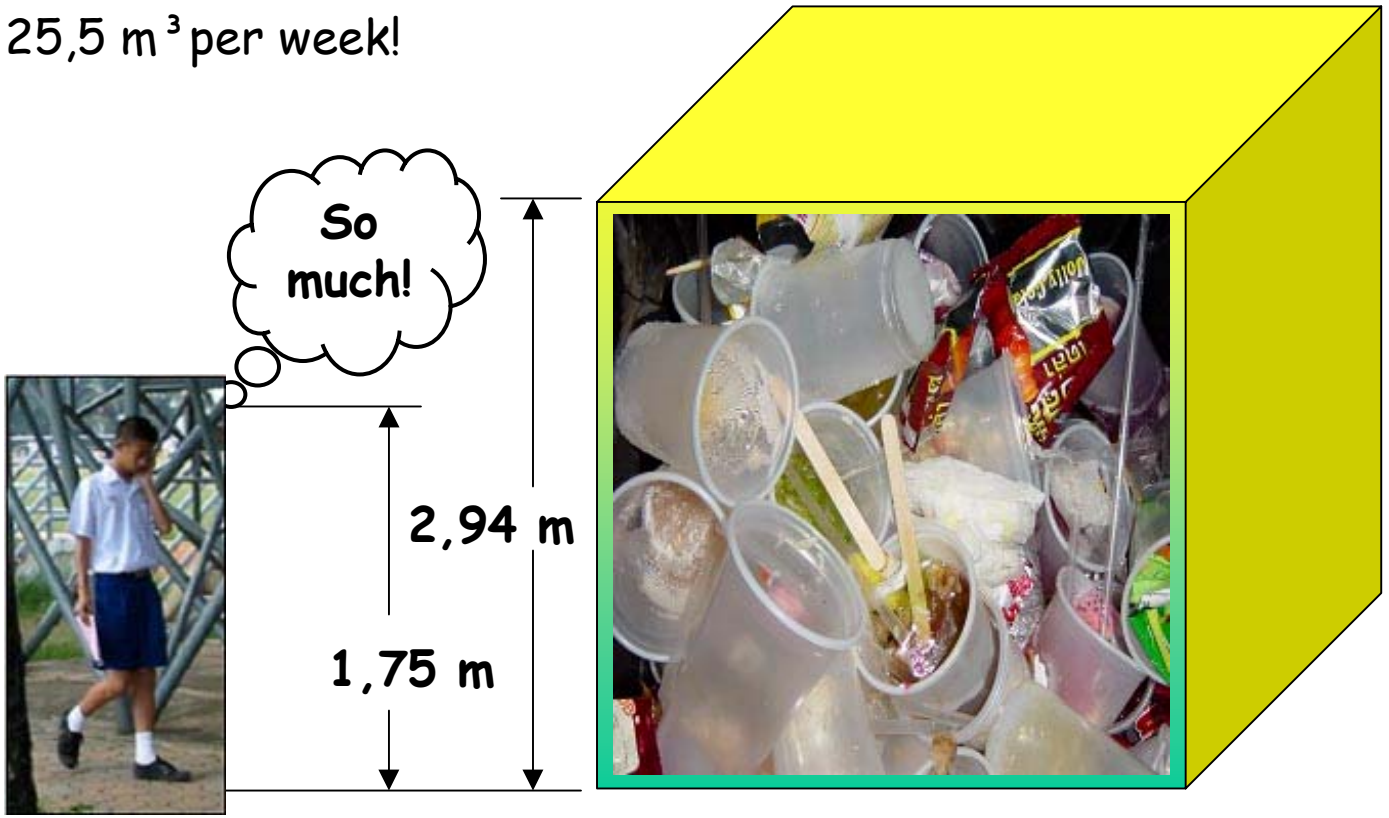
Waste has a value!

These 50% recyclable materials add up to a volume of 25,5 m³ per week!



Waste has a value!

Waste Type	Amount [kg/week]	Baht / week
Glass	131,18	
Paper, cardboard	326,85	
Plastic bottles	78,90	
Plastic cups	232,90	
Sum	769,83	

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Separate Waste Collection

Container Type / Waste Type	Colour & Type	…	…	…	…	…
Hazardous waste						
Tetra packs						
Metals						
Glass						
Paper, cardboard						
Fat						
Material < 40 mm						
Residual waste						
Plastics						
Garden waste						
Kitchen waste						

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Separate Waste Collection

Can we collect the following waste types separately?

Paper		Garden & Kitchen waste
Yes	No	Yes
Good → Recycling	Bad → Landfill plant	Good → Composting

Plastic cups		Plastic bottles
Yes	No	Yes
Good → Recycling	Bad → Landfill plant	Good → Recycling

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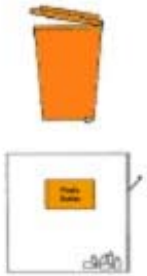
Separate Waste Collection at ACT

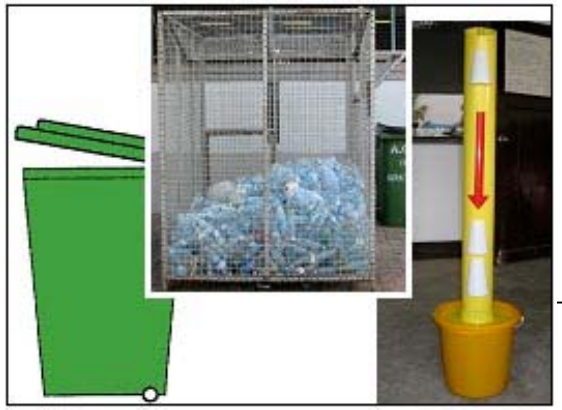
Waste fraction	Plastic cup	Plastic bottle	Paper	Food waste	Garden waste	Residual waste
Container colour	Red	Orange	Blue	-	Green	Yellow
Container type	Cup container	260 l Container or metal boxes	260 l container	Stainless steel 260 l container	260 l container	260 l container
Diagram						
Utilisation	Recycling	Recycling	Recycling	Partially Compost	Compost	Landfill

Separate Waste Collection




1.) Waste mixture 2.) Transportation 3.) Separation 4.) Limited recycling

1.) Separated waste



2.) Separate transportation

3.) Recycling