Coating process of solid dosage forms

Prof. emer. Dr. Klára Pintye-Hódi

2019. 11. 19.

Aims of coating

- to mask the taste, odour or colour of the drug
- to provide physical and chemical protection for the drug
- to separate incompatible ingredients
- to control the release of the drug from the dosage form
- to give an elegant finish to the tablet

Requirements of coating layer

- its surface is faultless, smooth, polished and uniformly;
- it has appropiate mechanical hardness;
- it protects the tablet core from the air, moisture and light;
- it masks the unpleasent taste perfectly;
- it dissolves rapidly in the gastric or intestinal juice, when it is necessary;
- it is as thin as possible;
- when the coating layer contains drug, it must be compatible.

Types of coating process

1. Sugar coating
   - subcoating
   - smoothing
   - colouring
   - polishing

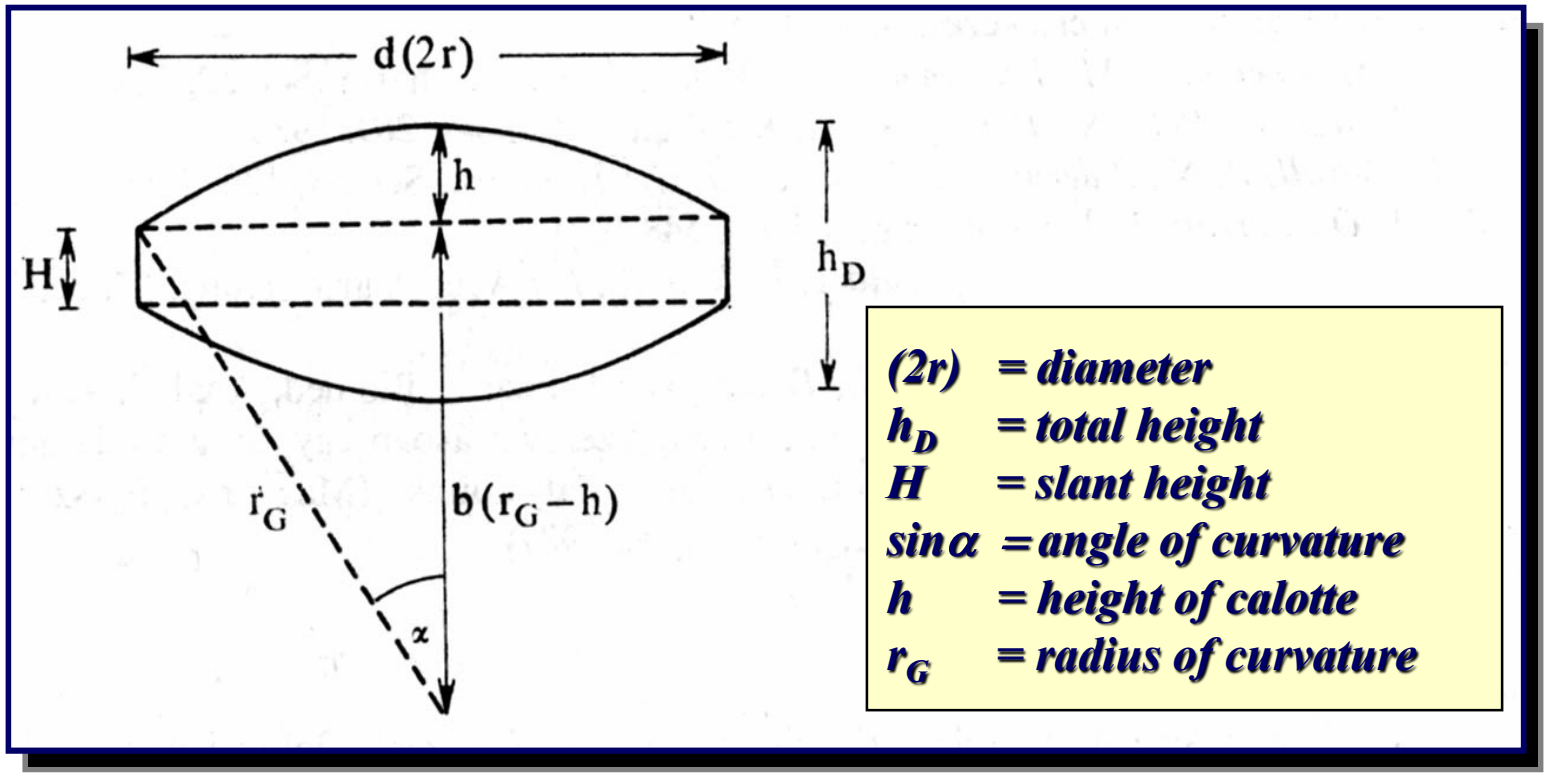
2. Film coating
   - gastric coated
   - enteric coated
   - permeable coating

3. Melted coating

4. Dry coating

5. Electrostatical coating

Characteristical parameters of tablet core

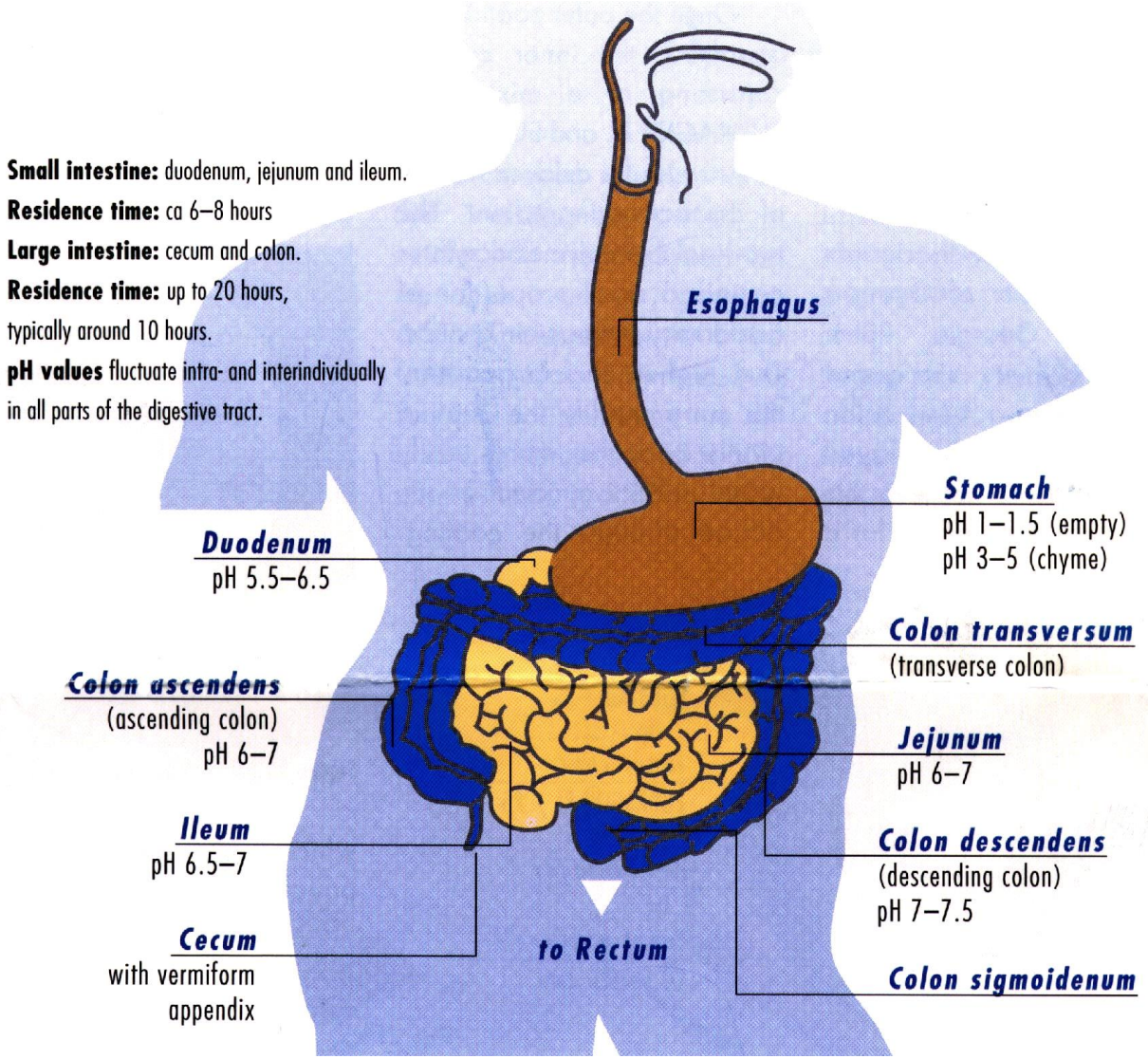


(2r) = diameter
h_D = total height
H = slant height
sinα = angle of curvature
h = height of calotte
r_G = radius of curvature

The important physiological factors

a) the length of time of passage
b) the role of pH
c) the effects of enyzmes

The pH in the GI tract

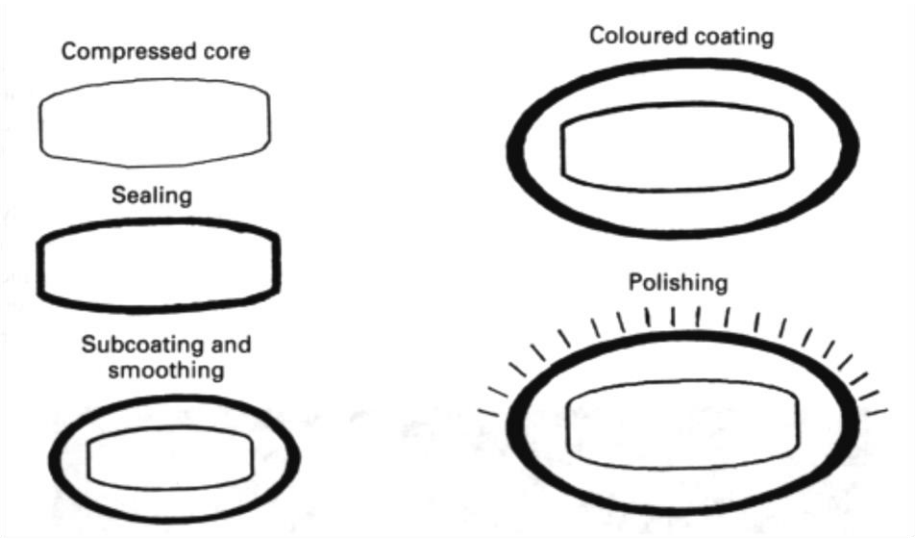


Sugar coating

Phases of sugar coating

Subcoating

Colouring



Smoothing

Polishing

Groups of colours

1. Synthetical colours
2. Vegetable and animal colours
3. Naturale pigments
4. Synthetical pigments
5. Lacker materials

Requirements

- lastingness of colour
- intense colouring effect
- the colours of different production series must be identical
- must be compatible
- must be resistant against atmospheric heat and moisture and production effects
- must be stable during a long storage period

Film coating

Disadventages of sugar coating

- *doubles the mass and increases the size*
- *harmful for children*
- *the sugar layer is brittle*
- *the sugar layer is not tropic-resistant*
- *the process needs long time*

Adventages of film coating

- *minimal mass increase*
- *a significant reduction in processing time*
- *increased process efficiency*
- *may be tropic-resistant*
- *pH-dependent or independent film*

Requirements of film coating materials

- *not toxic*
- *colourless, tasteless, odourless*
- *resistant against atmospheric effects*
- *chemically indifferent*
- *dissolve in the gastric or/and intestinal juices*
- *must be economical*

Film forming polymers (1)

Cellulose ethers

- *carboxi methyl cellulose (CMC)*
- *sodium or calcium carboxi methyl cellulose (Na or CaCMC)*
- *ethyl cellulose (EC)*
- *hydroxi ethyl cellulose (HEC)*
- *hydroxi propyl cellulose (HPC)*
- *hydroxi propyl methyl. cellulose (HPMC)*
- *methyl cellulose (MC)*

Cellulose esters

- *cellulose acetate phtalate (CAP)*
- *hydroxi propyl methyl cellulose phtalate (HPMCP)*

Film forming polymers (2)

Copolymers of methacrylic acid

- *Eudragit L 100-55 ill. L30D*
- *Eudragit S 100*
- *Kollicoat MAE 30DP*

Amino alkyl methacrylate copolymer

- *Eudragit E 100*

Film forming polymers (3)

Methacrylic ester copolymer

- *Eudragit RL 100 ill. RL 30D*
- *Eudragit RS 100 ill. RS 30D*
- *Eudragit NE 30D*
- *Kollicoat EMM 30D*

Polivynil acetate copolymer

- *Kollidon VA 64*
- *Kollicoat SR 30D*

Polivynil pyrrolidone

- *Kollidon*

Acryl-EZE,
Acryl-EZE MP

Types of aqueous polymers dispersion

Sustained release (neutral groups)

Ethyl cellulose
- **Aquacoat ECD,**
- **Surelease**

Methacrylic ester copolymer
- **Eudragit NE, RL, RS**
- **Kollicoat EMM**

Polivynil acetate copolymer

Kollicoat RS

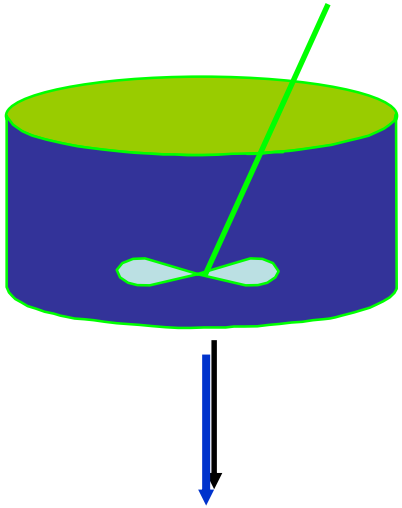
Delayed release (acidic groups)

Cellulose esters
- **Aquacoat CPD**

Acrylate copolymers
- **Eudragit L,**
- **Kollicoat MAE**

Process of polymerization

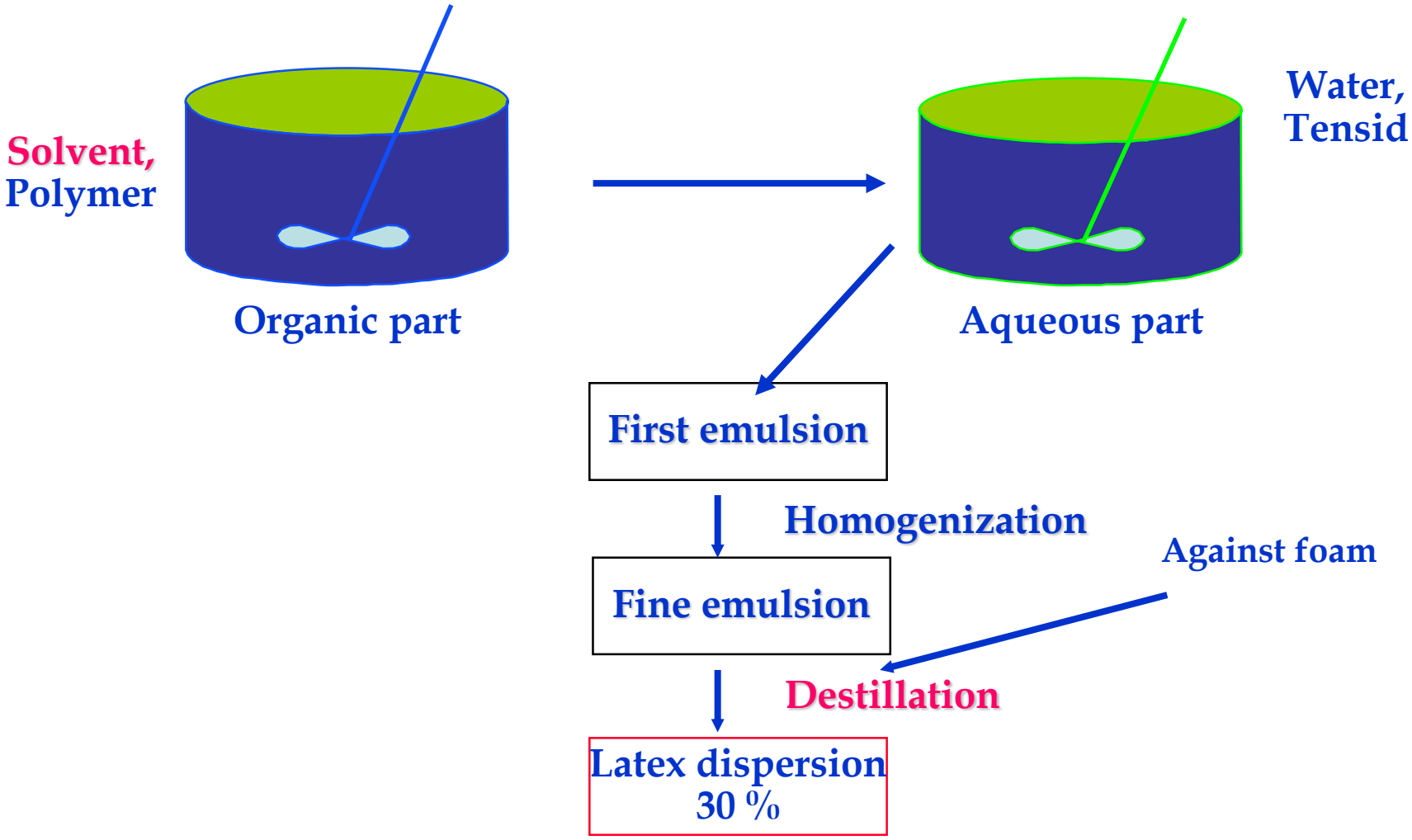
Aqueous part



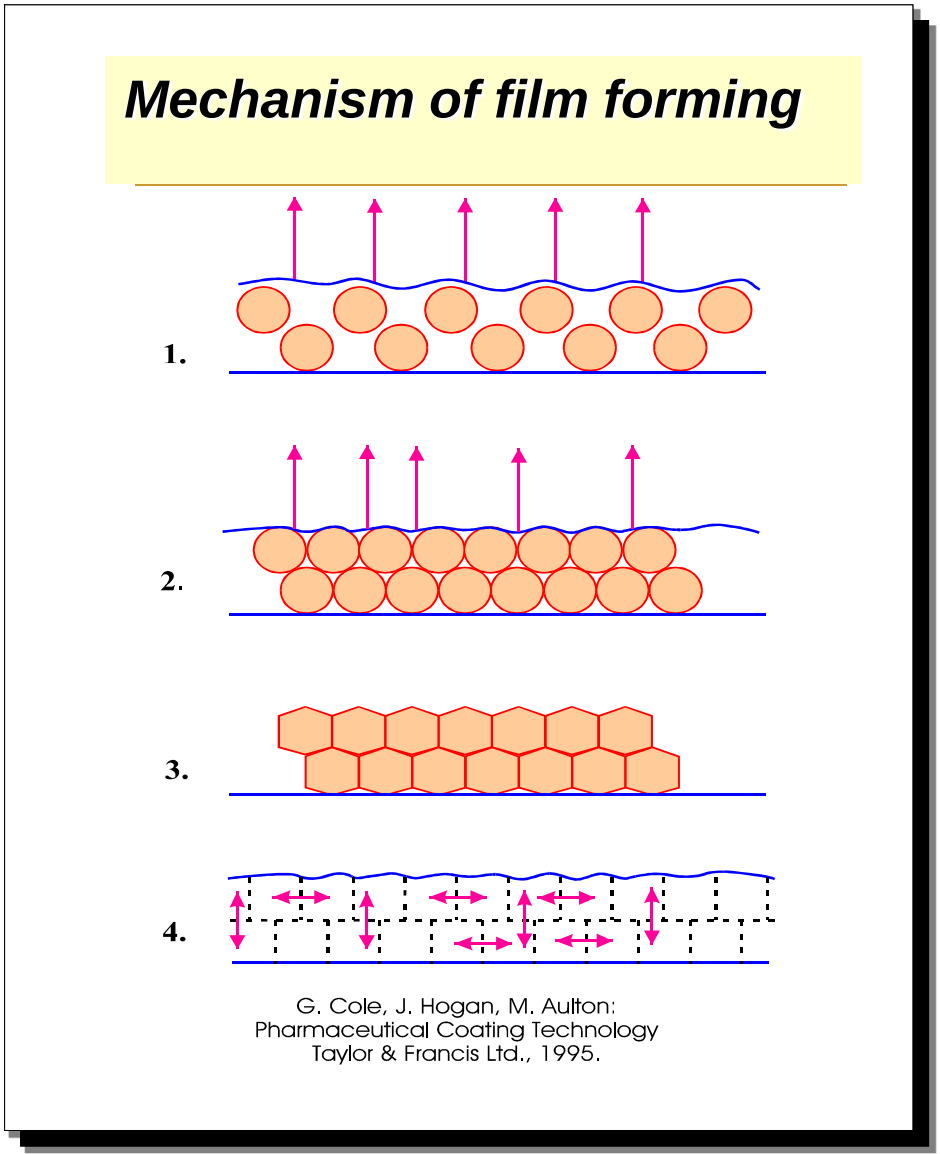
Water
Monomer
Tensid
Catalyst

Latex dispersion
30 %

Process based on solvent evaporation



Mechanism of film forming from aquaeous dispersion



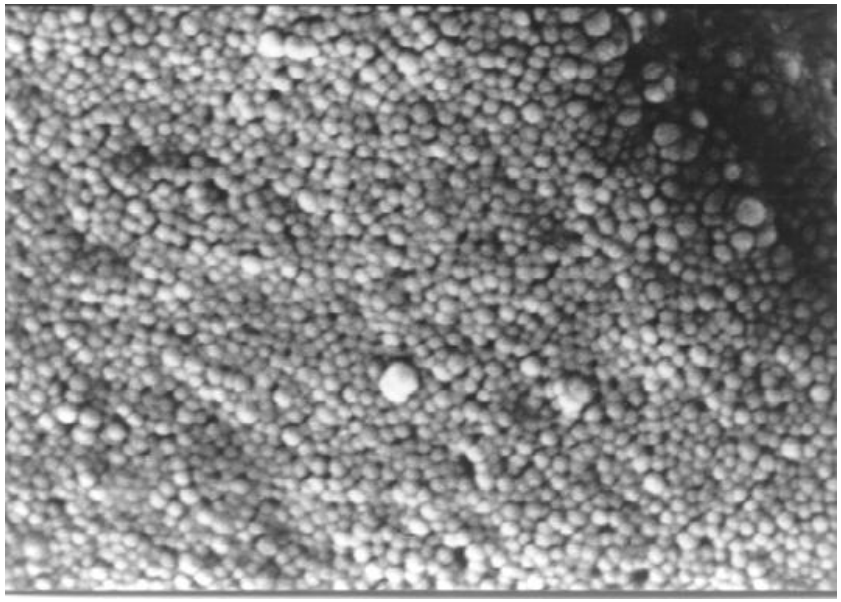
1. Water evaporation, capillare forces act between particles.

2. The particles close up.

3. Deformation of particles.

4. Coalescence of particles.

Mechanism of film forming



Starting of coalescence

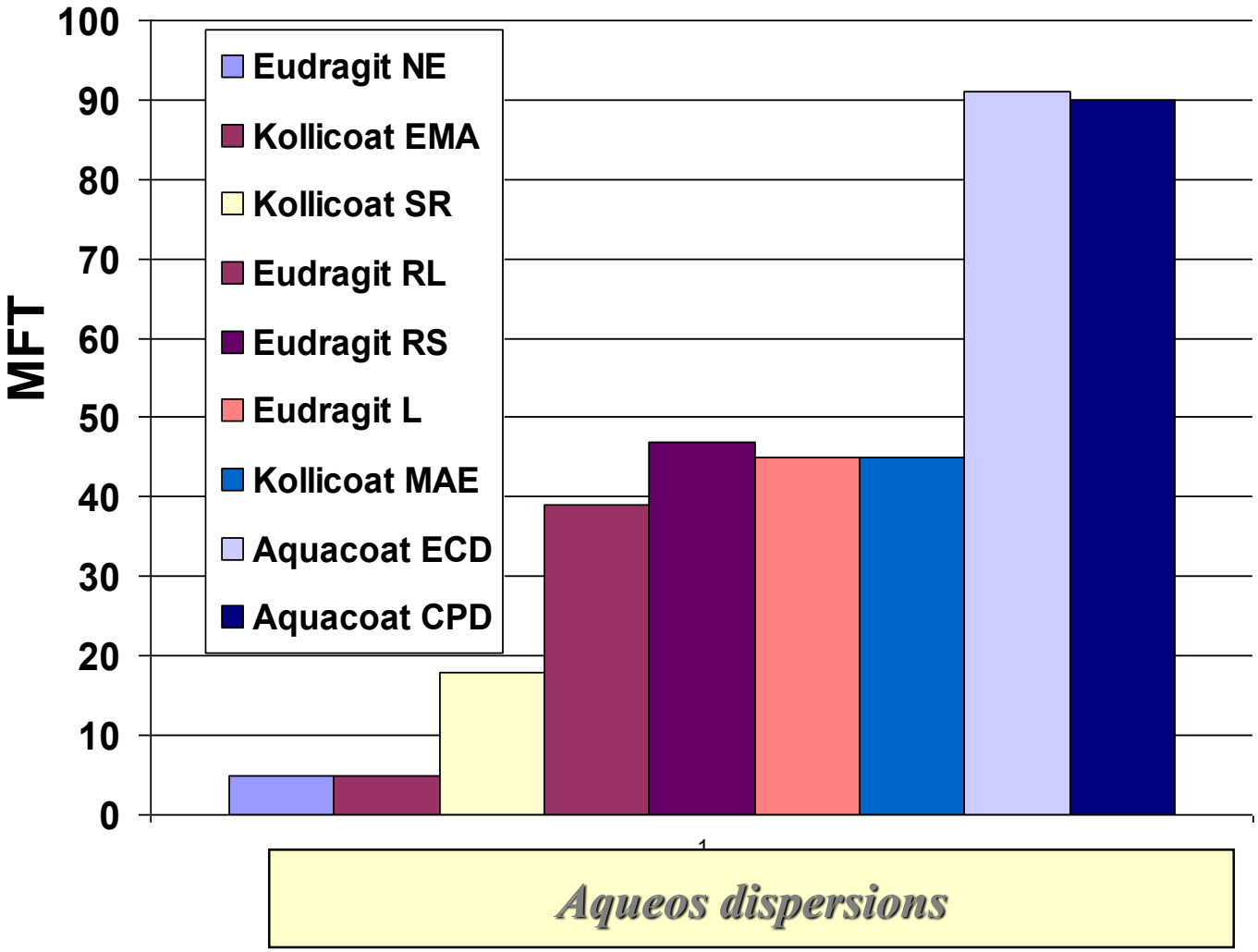
Finishing of coalescence

MFT is the key-parameter!

The temperature needs to form a homogen, trasparence film.

During coating the drying temperature must be 10-15 °C above MFT

Minimal film forming temperature (MFT)



Plasticizers

Groups

1. Polyols

- glycerol
- propylen glycol
- PEG 200-6000

2. Organic esters

- phtalate esters (dietyl, dibutyl)
- dibutyl sebacate
- citrate esters (trietyl, acetyl-trietyl, -tributyl)
- triacetin

3. Oils/glycerids

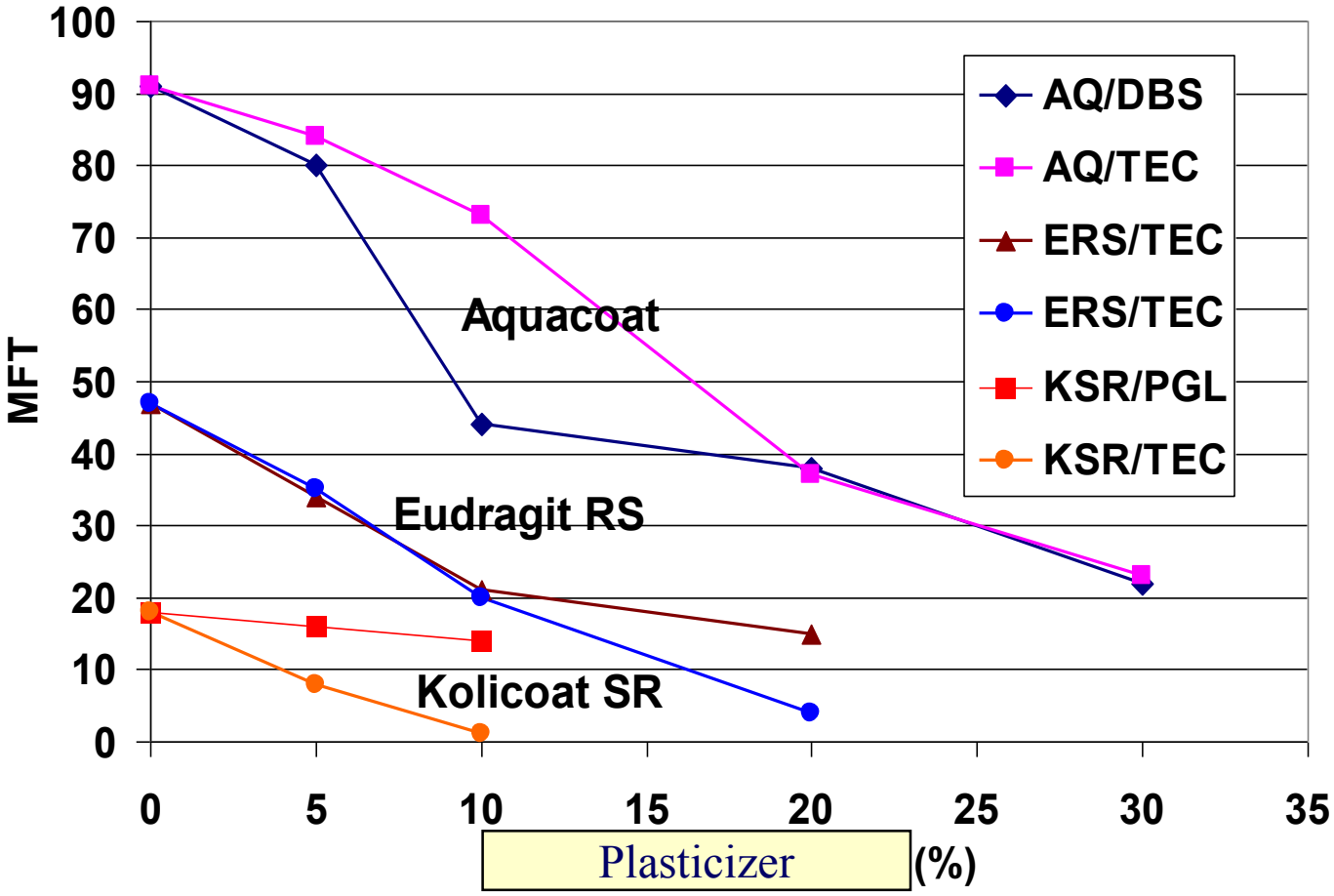
- castroil oil
- acetyl monoglycerids
- cocoa-nut oil

Decrease of the MFT

Plasticizers (10 -30 %)

Triethyl citrate
Dibutyl sebacate
Glyceryl triacetate (Triacetin)
Propylene glycol
Polyaethylene glycol
Diethyl phthalate, Dibutyl phthalate
Acetyl triethyl citrate
Acetyl tributyl citrate

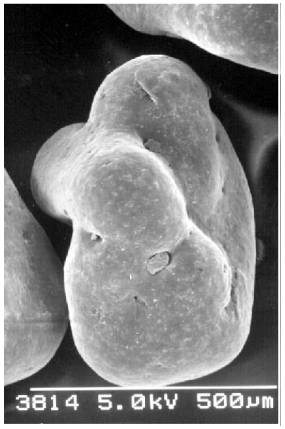
Effect of plasticizers on the MFT

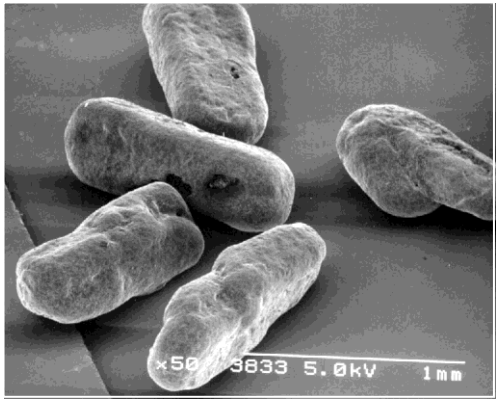


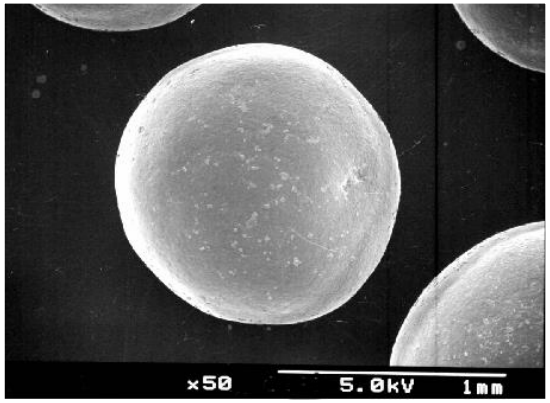
Effect of plasticizers

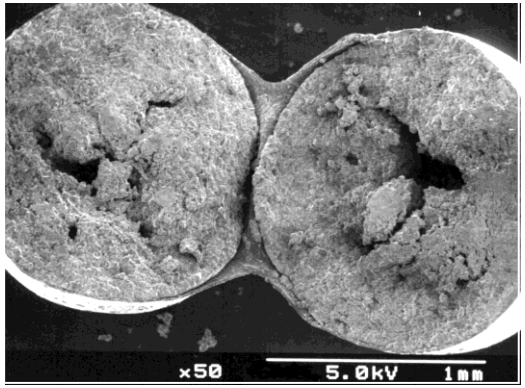
- decrease the minimal film forming temperature
- increase the elasticity of films
- decrease the tensile strength of the films
- increase the stickiness of the film
- influence the dissolution rate

Film coated crystals, pellets









Melted coating

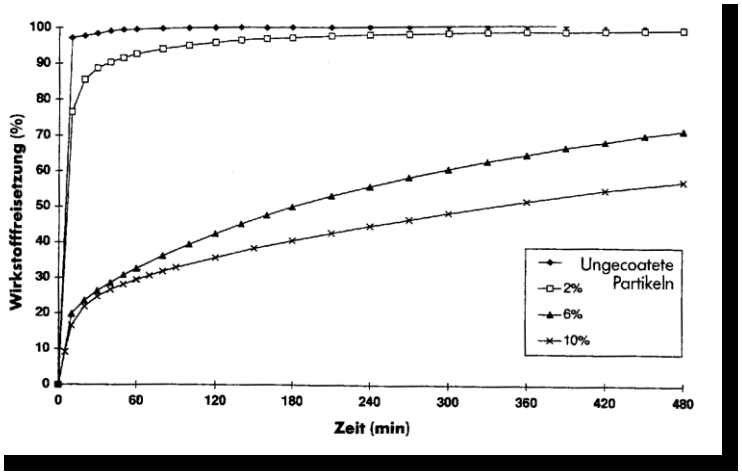
Adventages:

- *shorter process time*
- *the coating materials are used in the food industry*
- *economical*
- *the drug release may be controlled by the temperature*

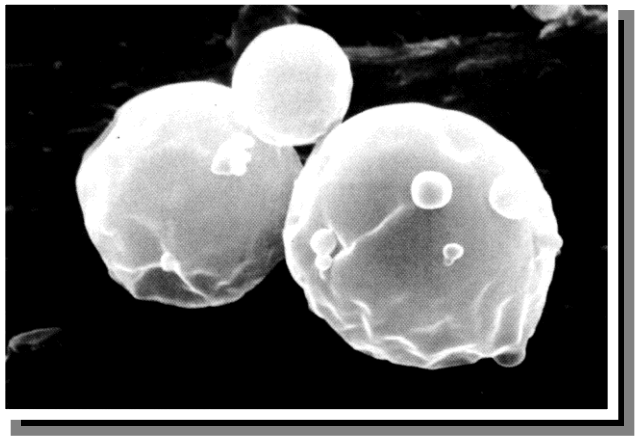
Coating materials

- *chocolate*
- *PEG 4000 és 6000*
- *waxes*
- *lipid esters*

Melted coating

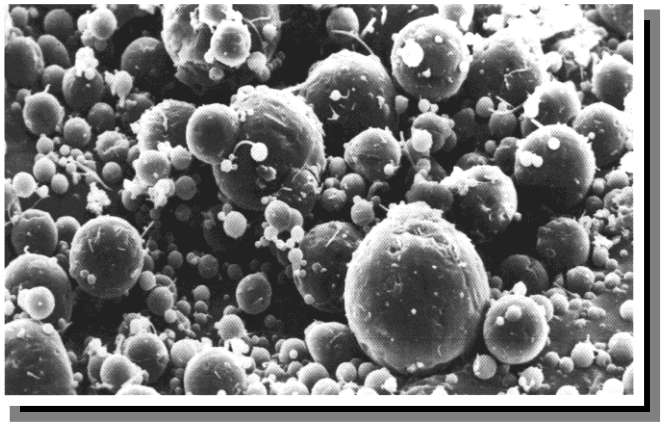


Release of Theophylline coating material: Compritol 888 ATO



Precirol ATO 5

(gliceryl palmitosztearate)



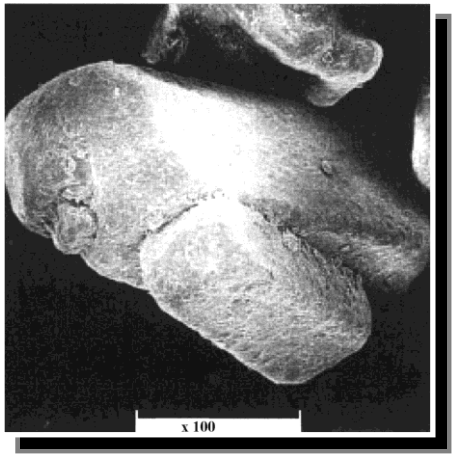
Compritol 888 ATO

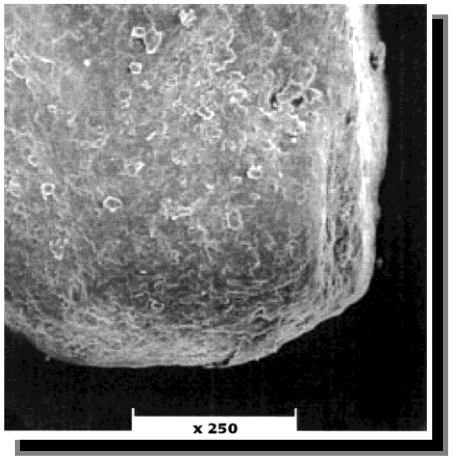
(gliceryl.behenate)

Melted coating

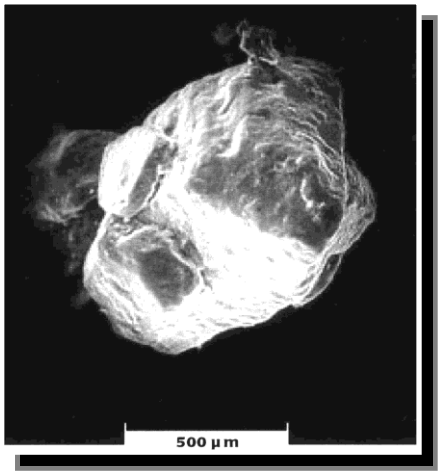
Gattaprine (Acetyl salicylic acid)

(gliceryl-behenate)





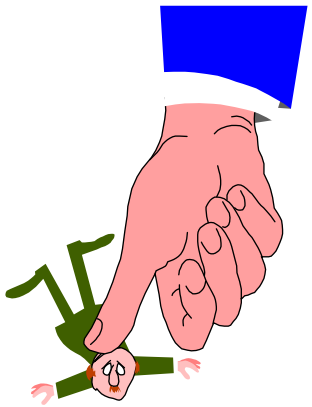
Gattaphen T (Paracetamol)

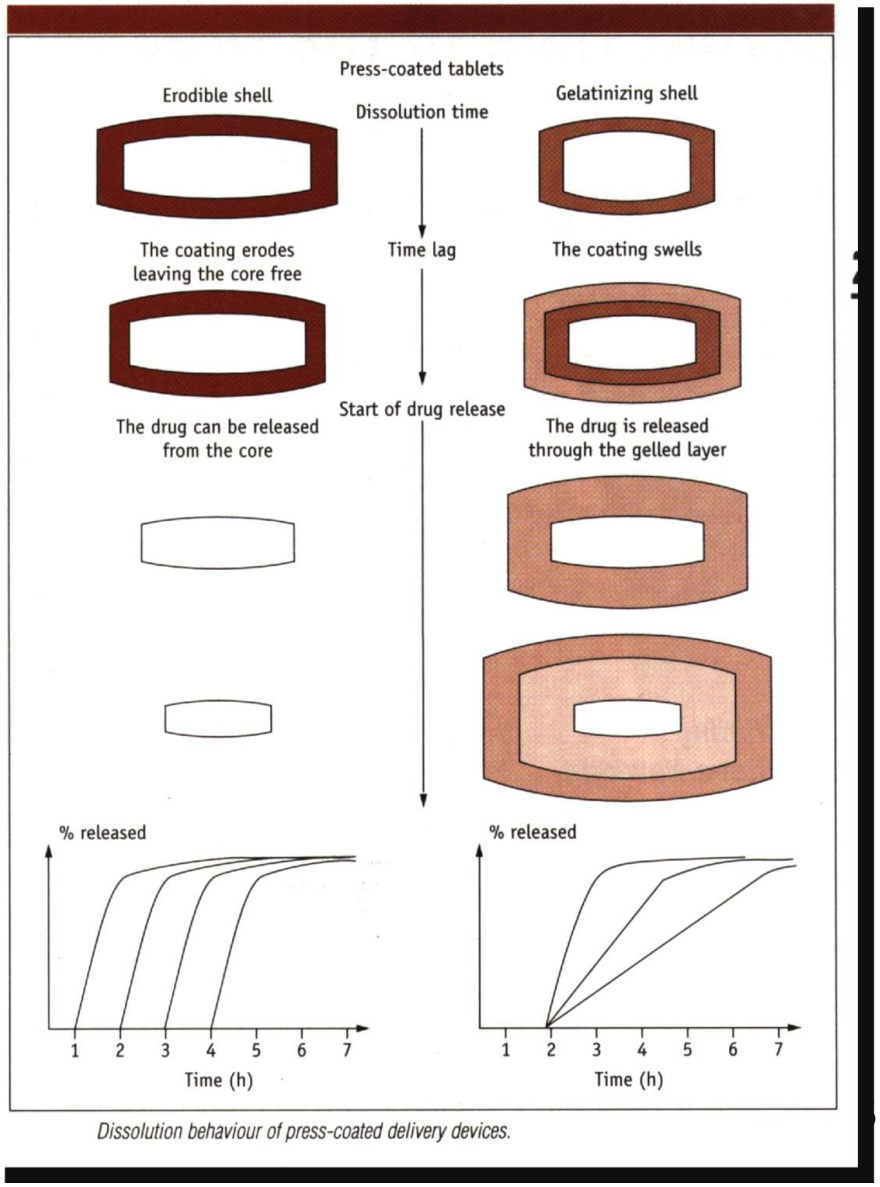


(gliceryl palmitosztearate)

Dry coating

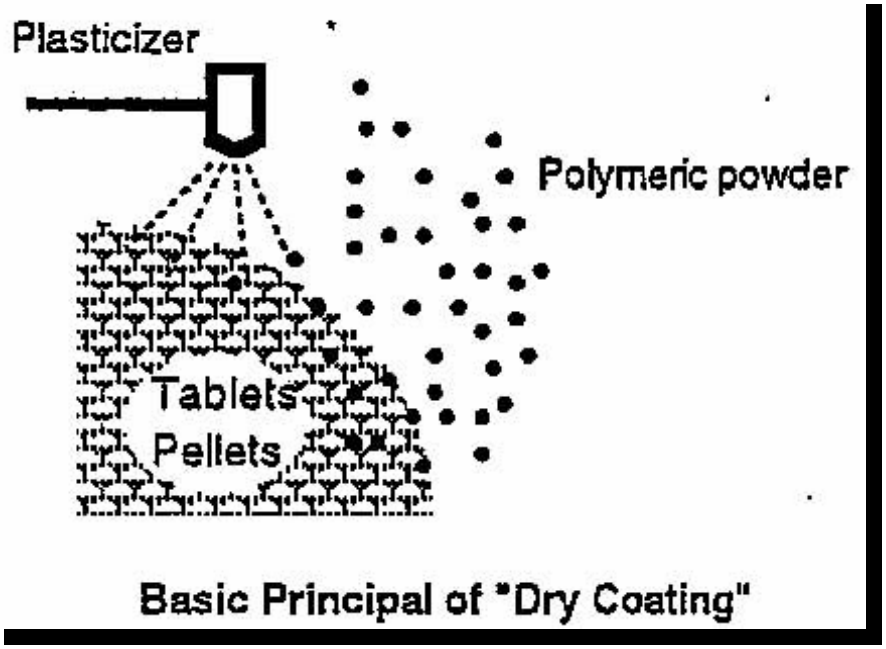
Compressed coating



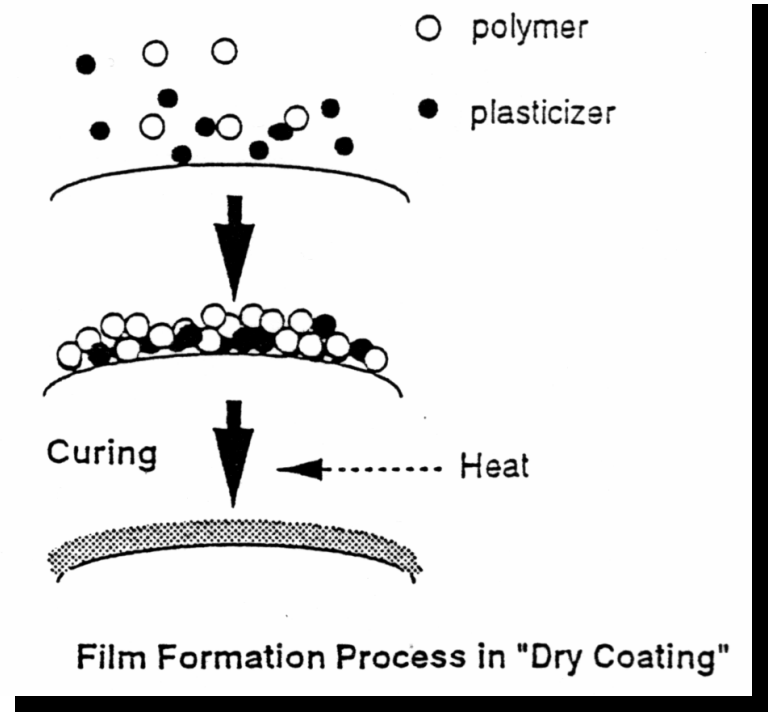


Dissolution behaviour of press-coated delivery devices.

Coating with polimer powder

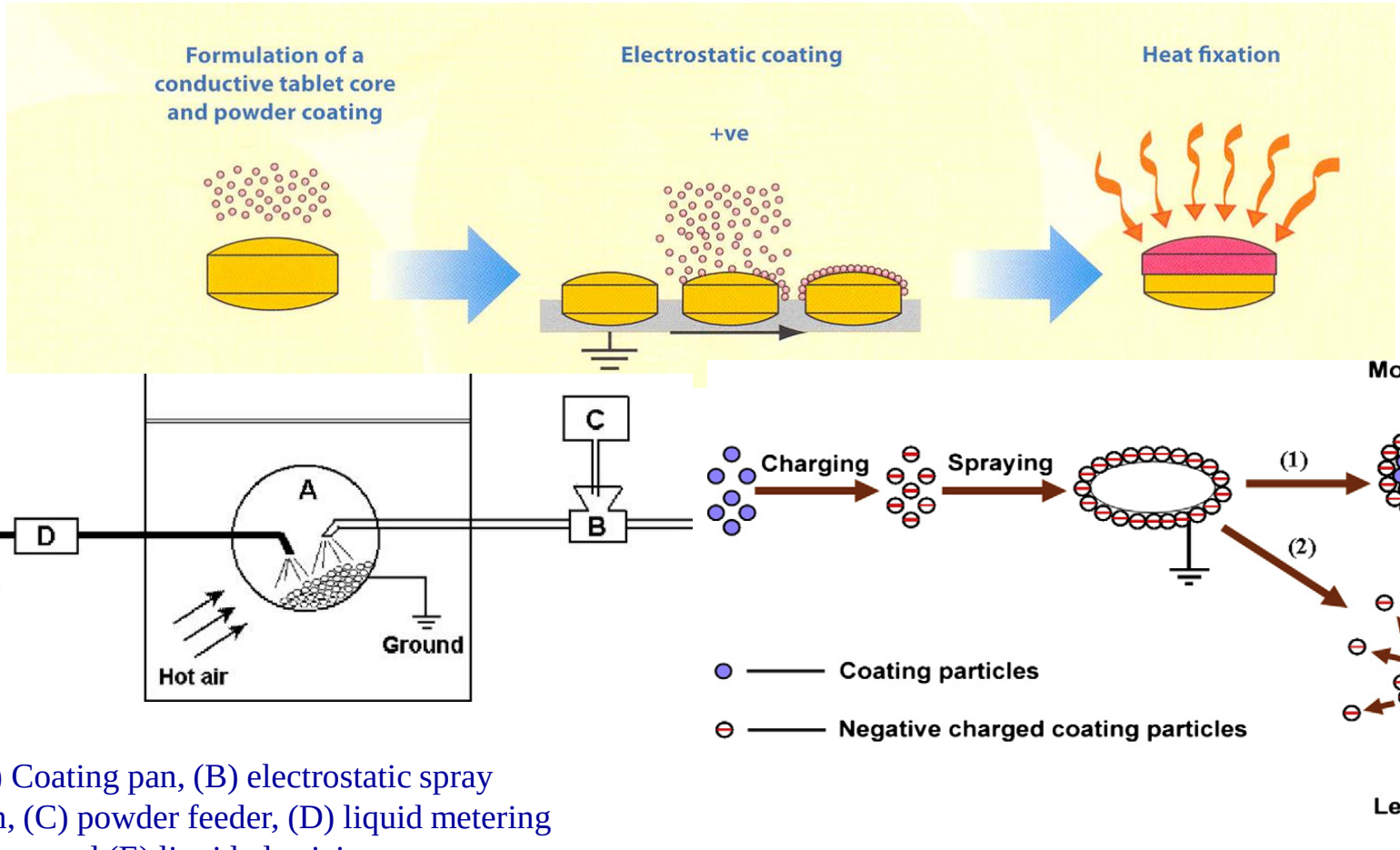


Basic Principal of "Dry Coating"



Film Formation Process in "Dry Coating"

Electrostatic coating

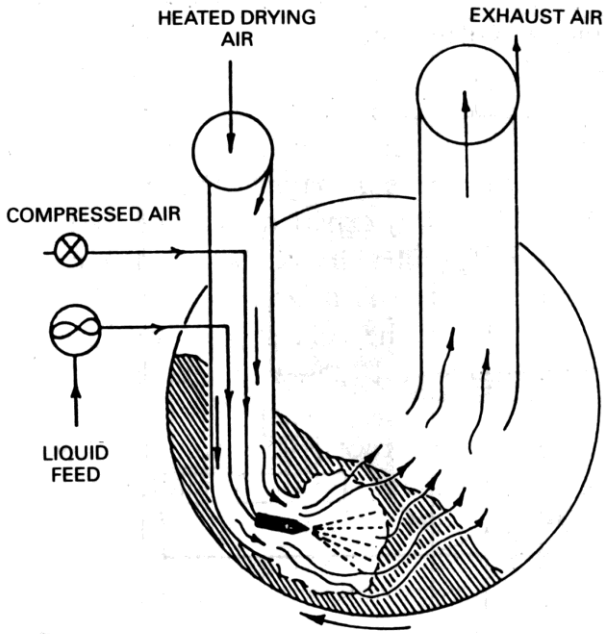


(A) Coating pan, (B) electrostatic spray gun, (C) powder feeder, (D) liquid metering pump, and (E) liquid plasticizer

Mingxi Qiao et al: A novel electrostatic dry powder coating process for pharmaceutical dosage forms: Immediate release coatings for tablets, EJPB, 2010, 78,304-310

Manufacturing

Coating pan



g. 8.3 Standard coating pan using the immersion tube system.

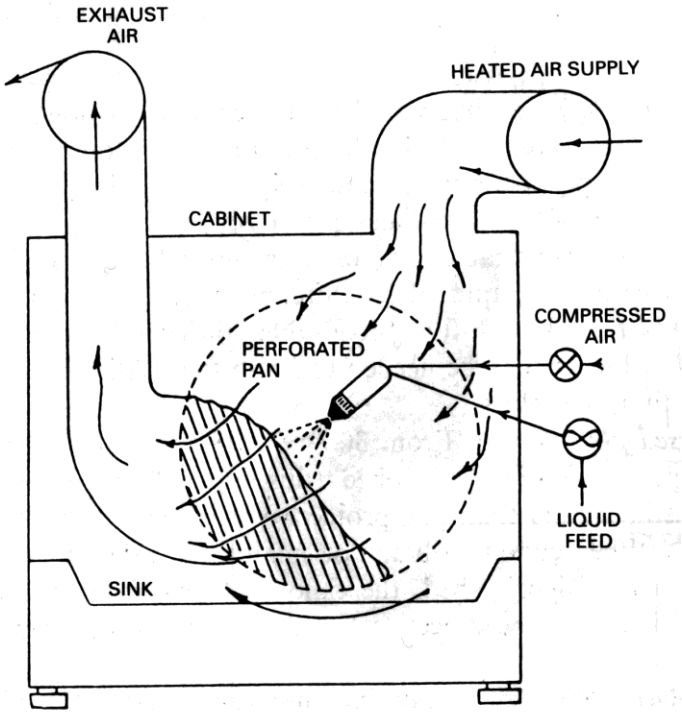
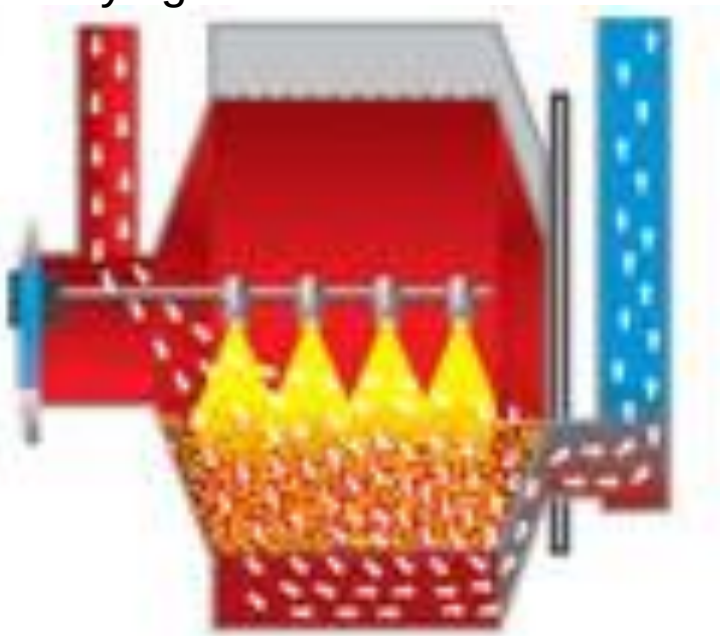


Fig. 8.4 Manesty Accelacota.

Hi-coater

Heated drying air

Exhaust air



Heated drying air

Exhaust air

Coating equipment

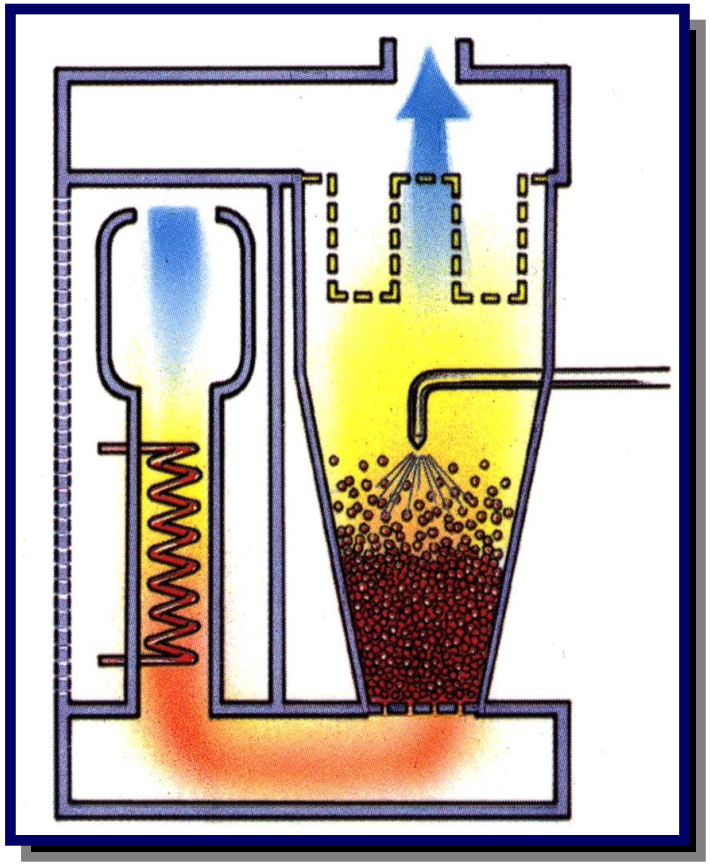
LAB-coater

spray gun

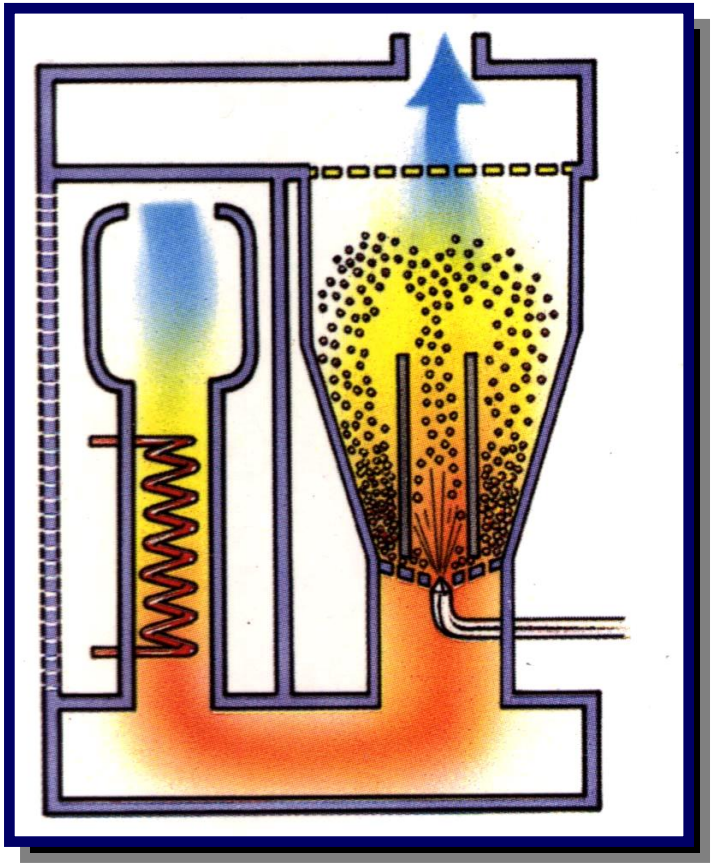
Accelacota 10 Perforated Pan Coater

Moving Tablet Bed in Perforated Pan

Fluid bed coating

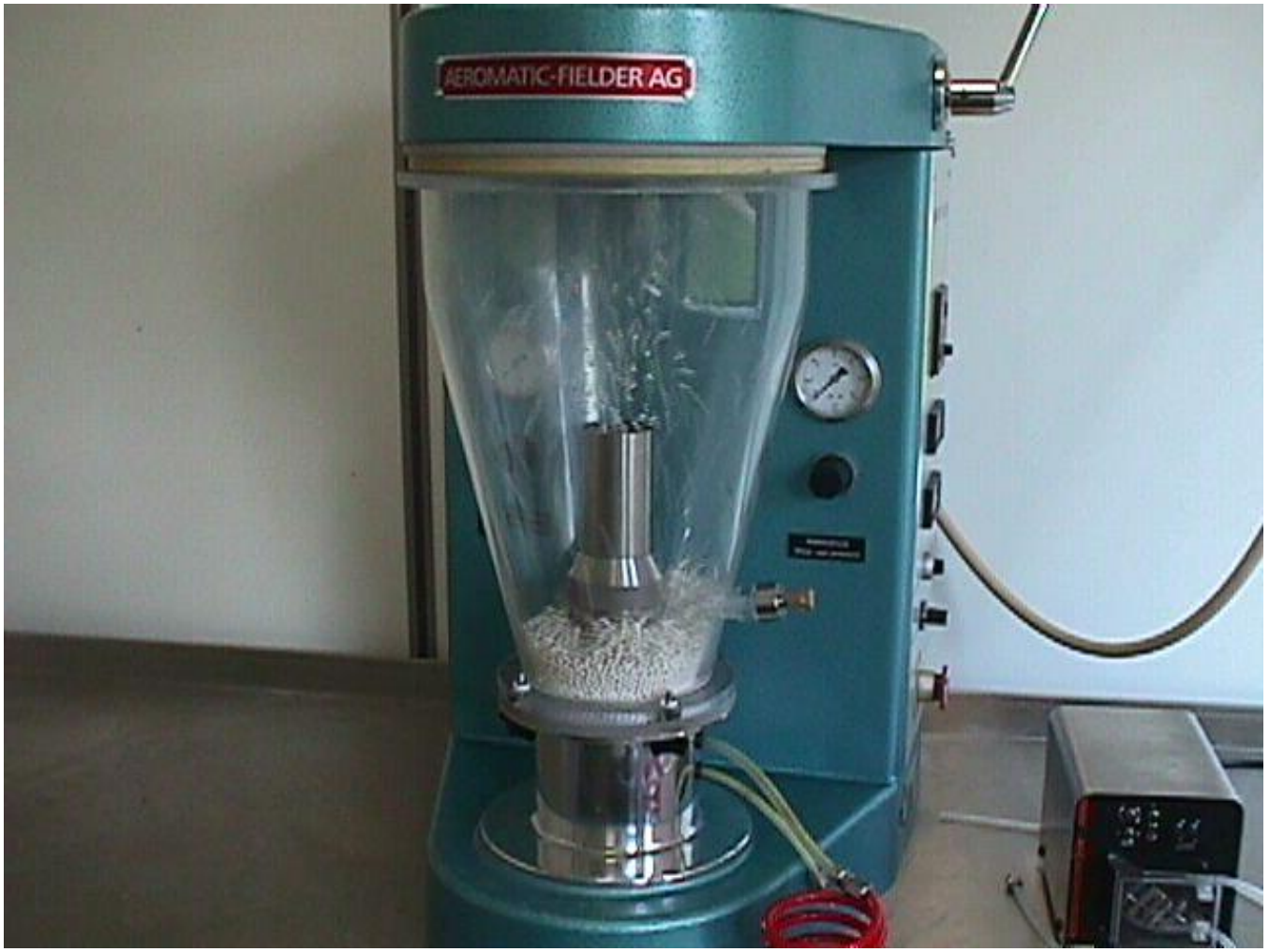


Upper spraying (Strea-1)

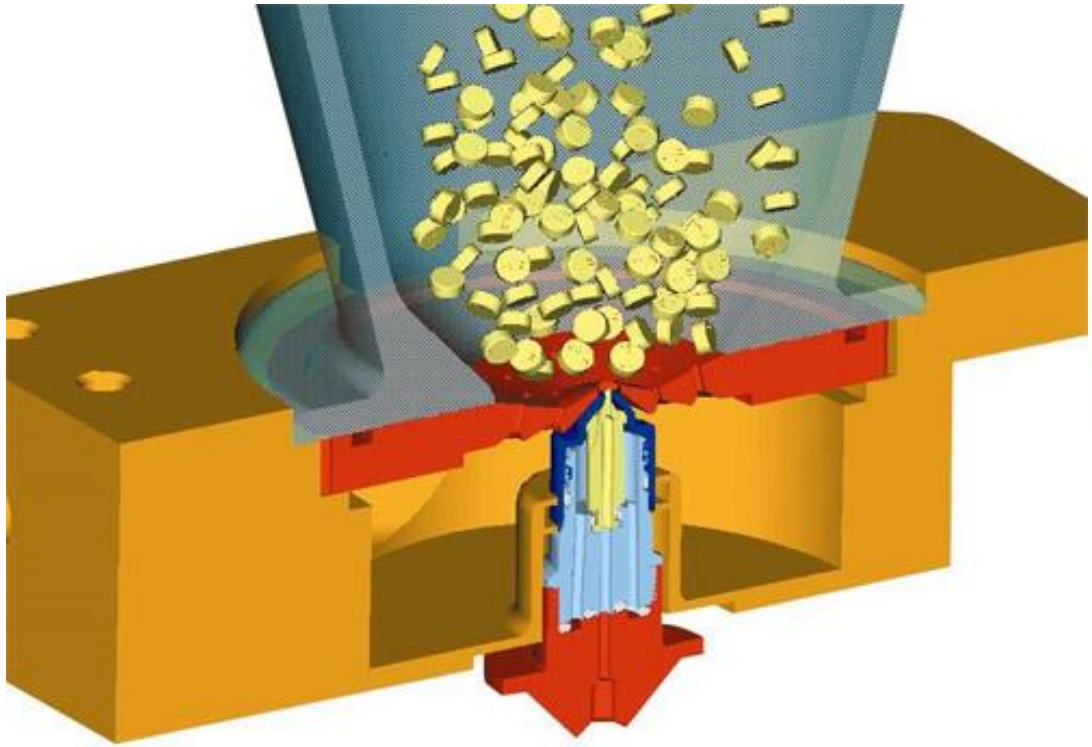


Lower spraying (Strea-1)
(Wurster principle)

Wurster Fluid Bed Coating



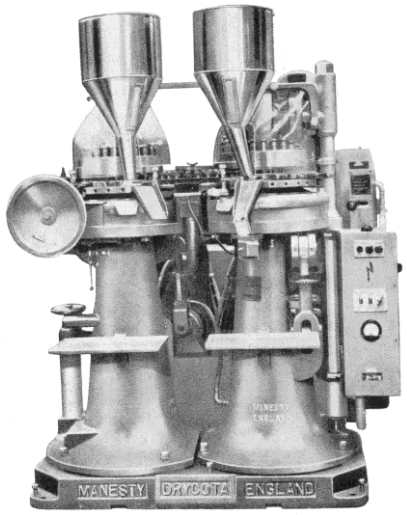
Supercell

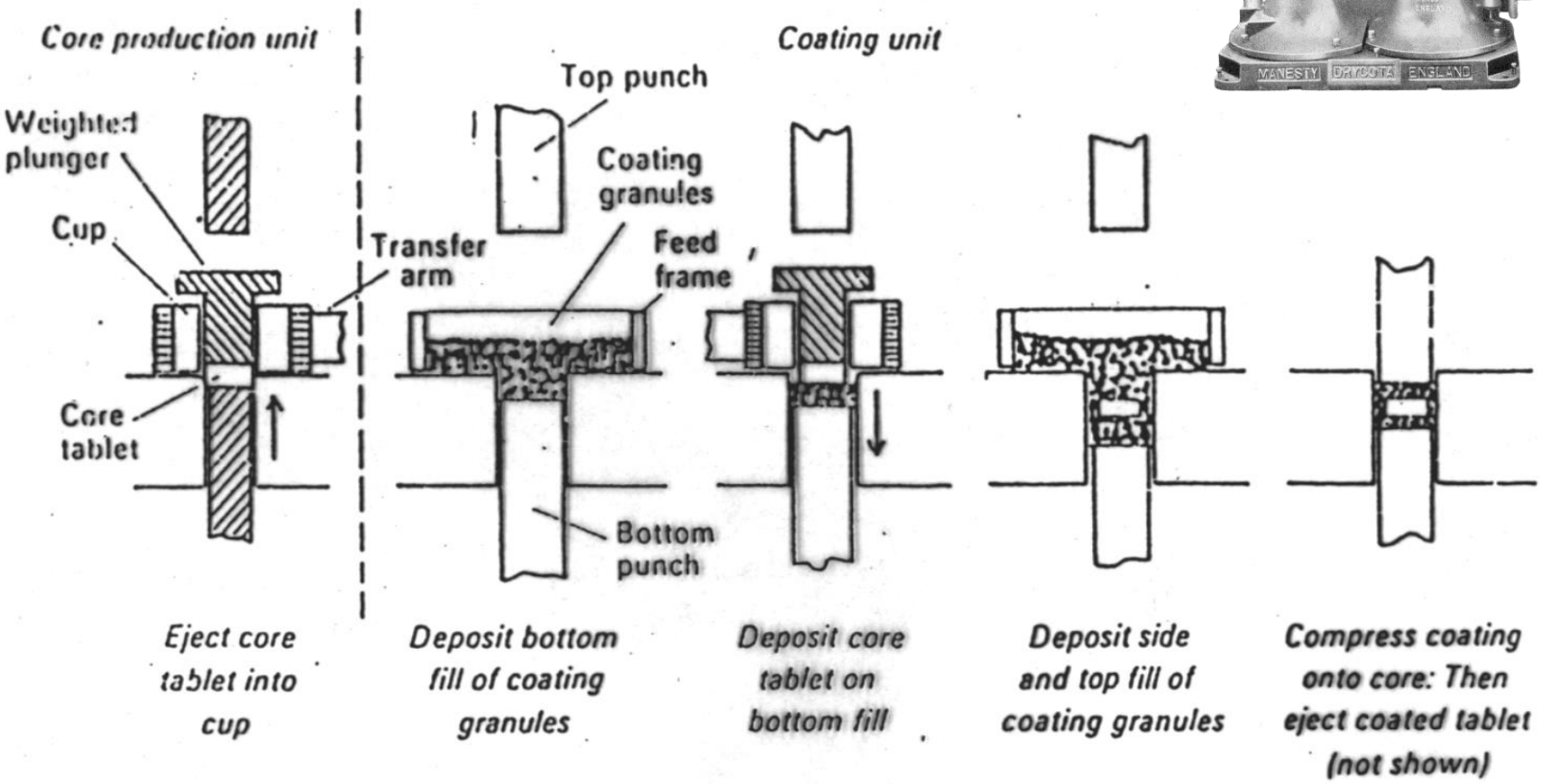


Continous coater

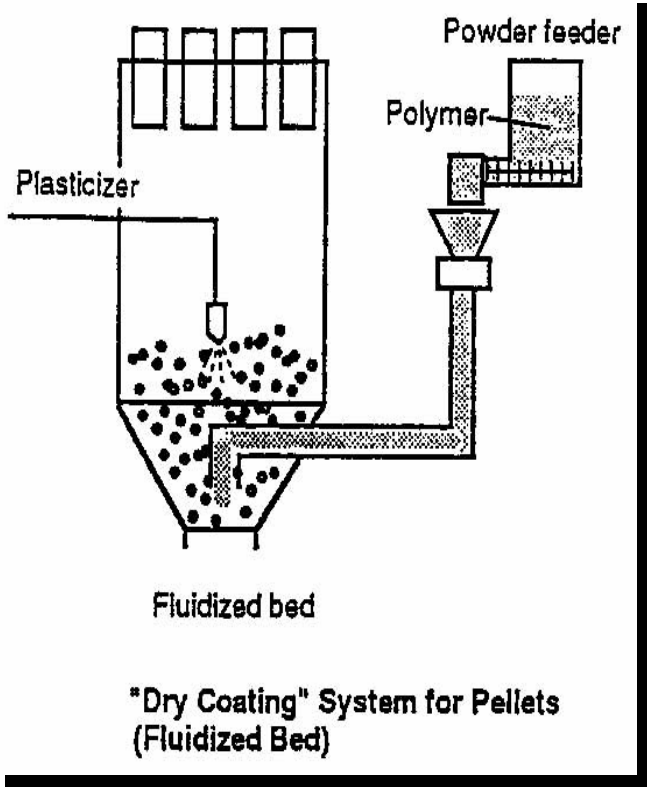
O’Hara

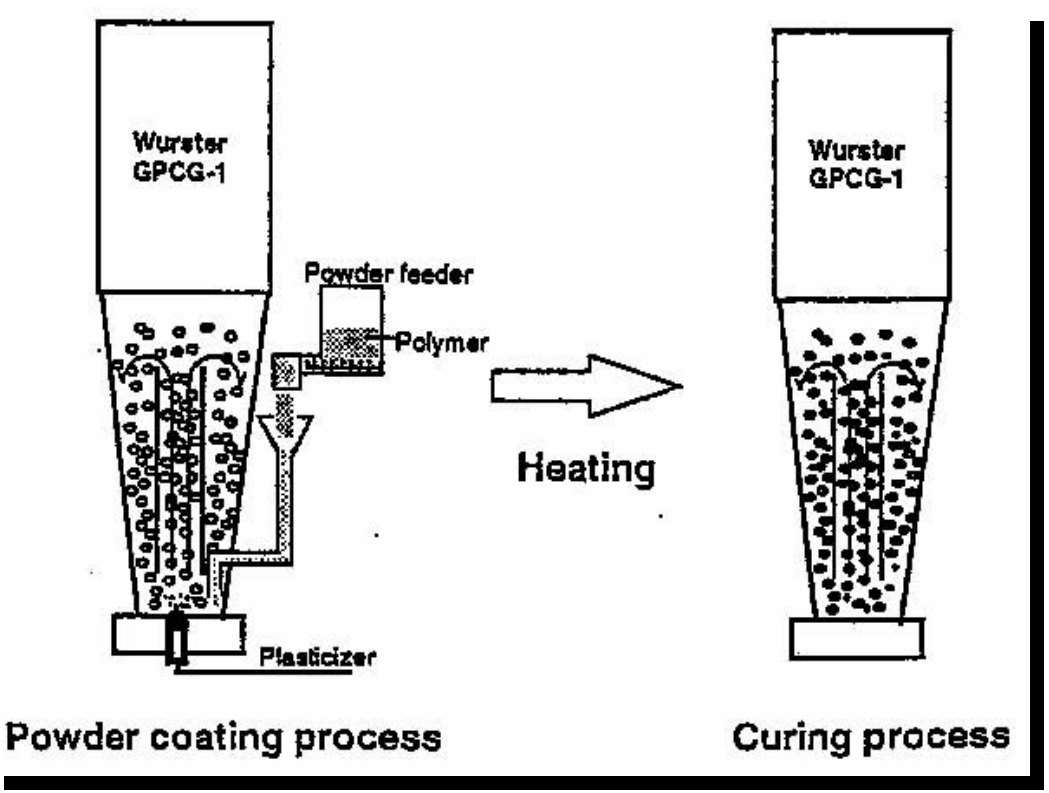
Compressed coating





Dry coating in fluid bed apparate (pellet)





Tests

Aim:

1. Suitable for the therapy (uniformity of mass, assay, content uniformity)

2. Meeting the requirements of packaging and transport (size parameters, mechanical hardness, etc.)

3. The drug release is suitable (bioavailability)

Tests (1)

1. Core

- *macroscopical test, uniformity of mass, geometry*
- *test of composition (identity, purity, assay, content uniformity)*
- *mechanical test (breaking hardness, friability)*
- *disintegration time*
- *porosity*
- *drug release*

Tests (2)

2. The colour and glitter of coating

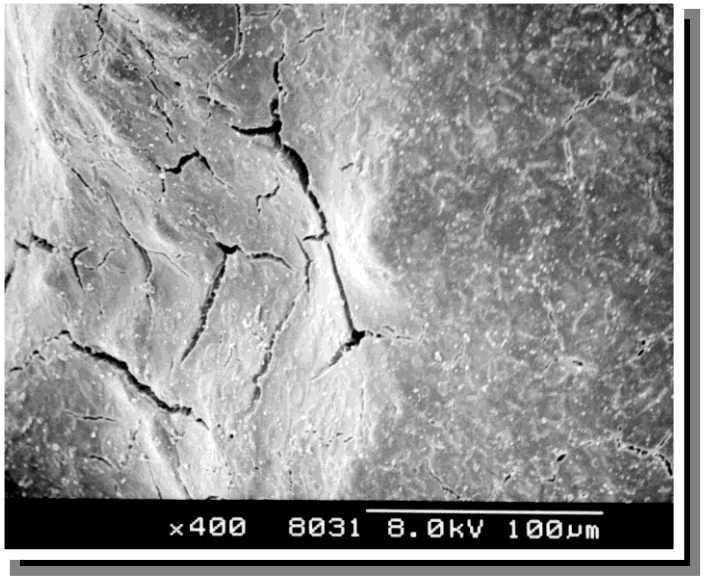
- *shade of colour, tonality, deep of colour*
- *reflection*

3. Finaly coated dosage form

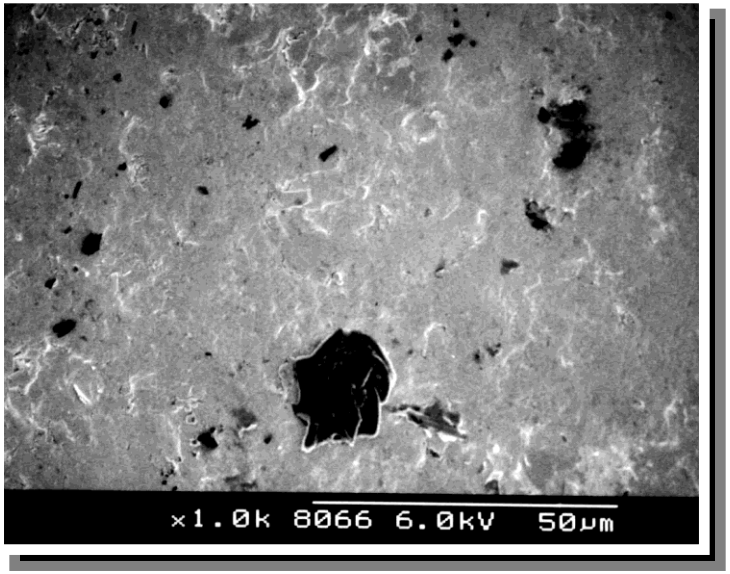
- *disintegration*
- *drug release*

Coating defects

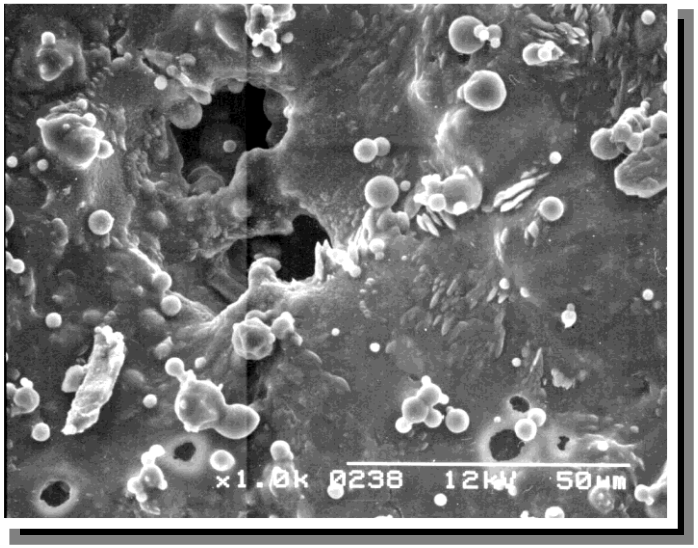
cracking



cratering

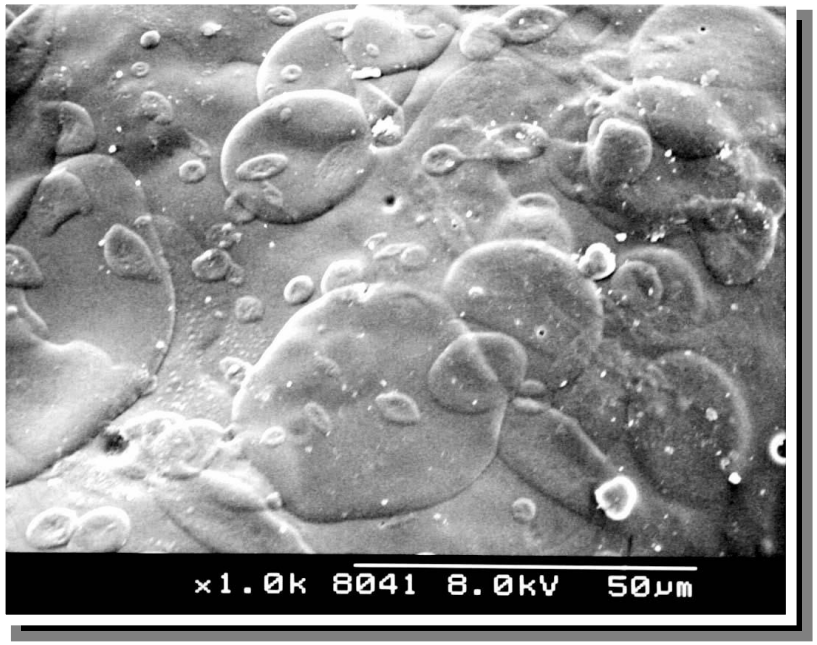


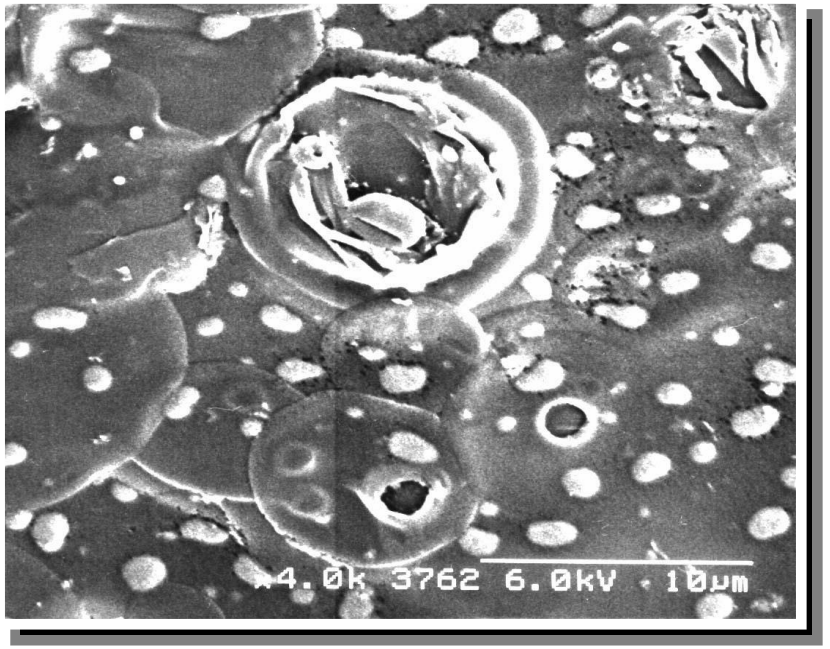
bridging



Coating defects

layering

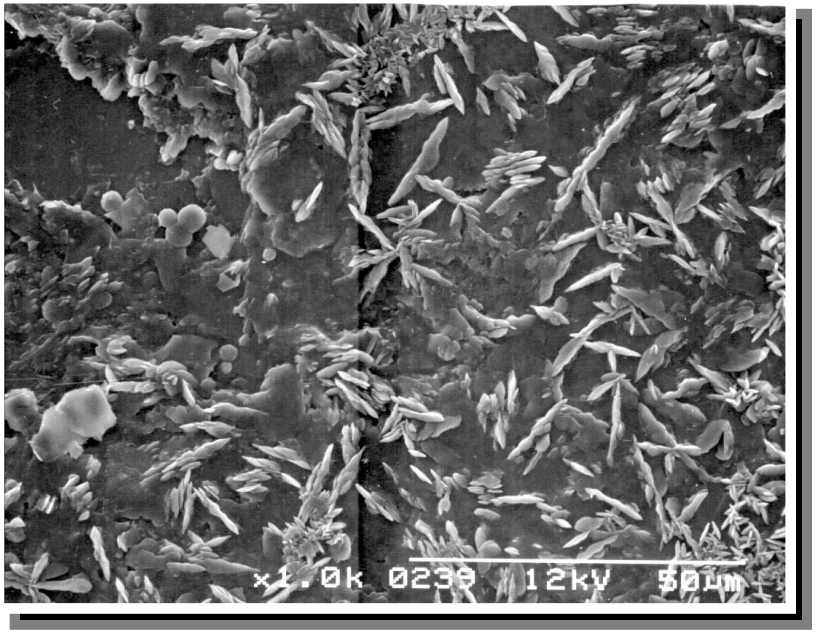


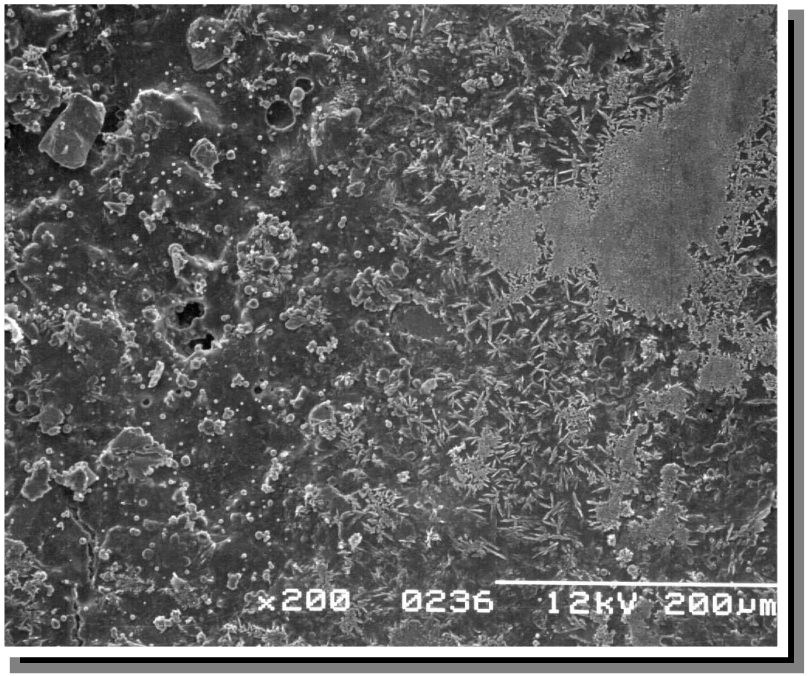


bubbling

Coating defects

recrystallization

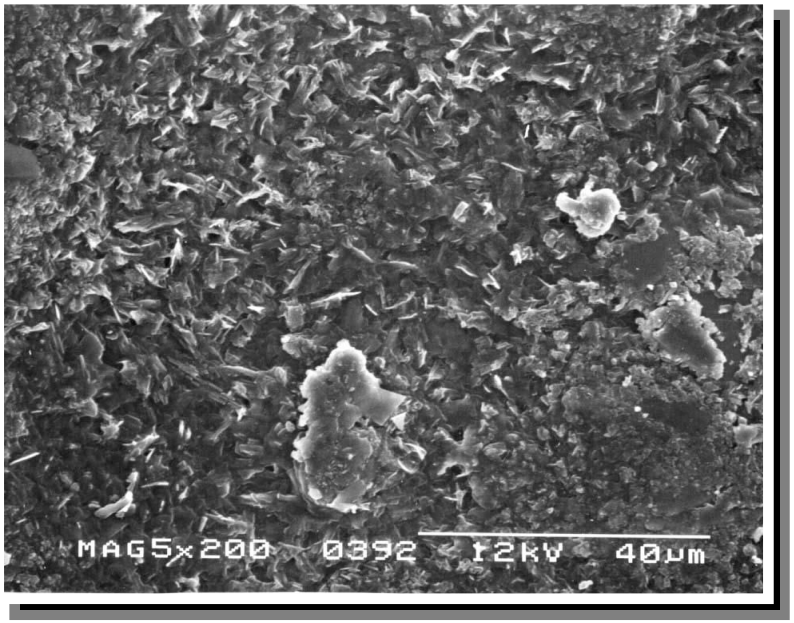


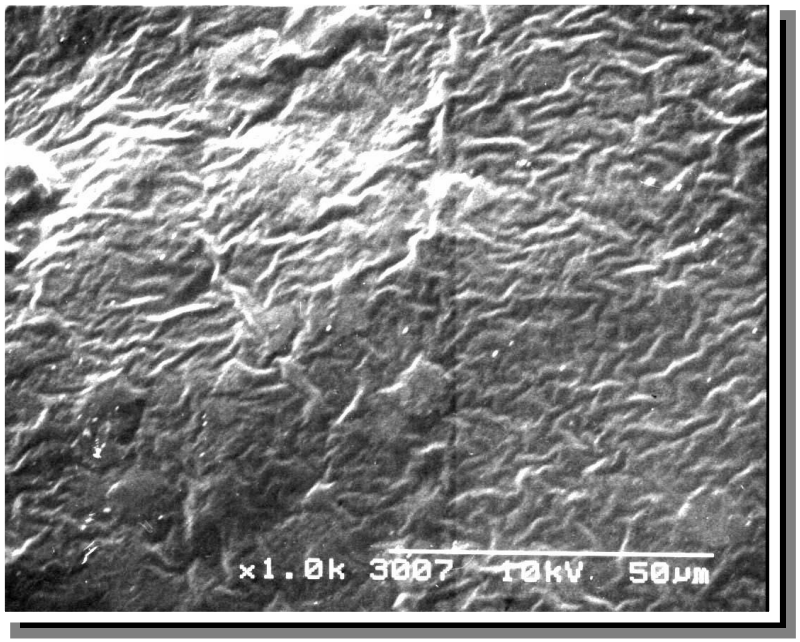


marbly

Coating defects

scaly

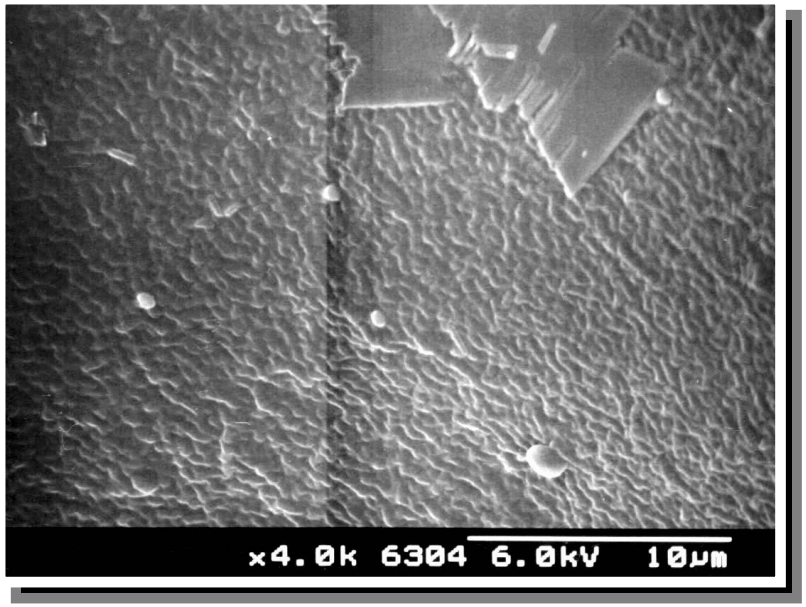


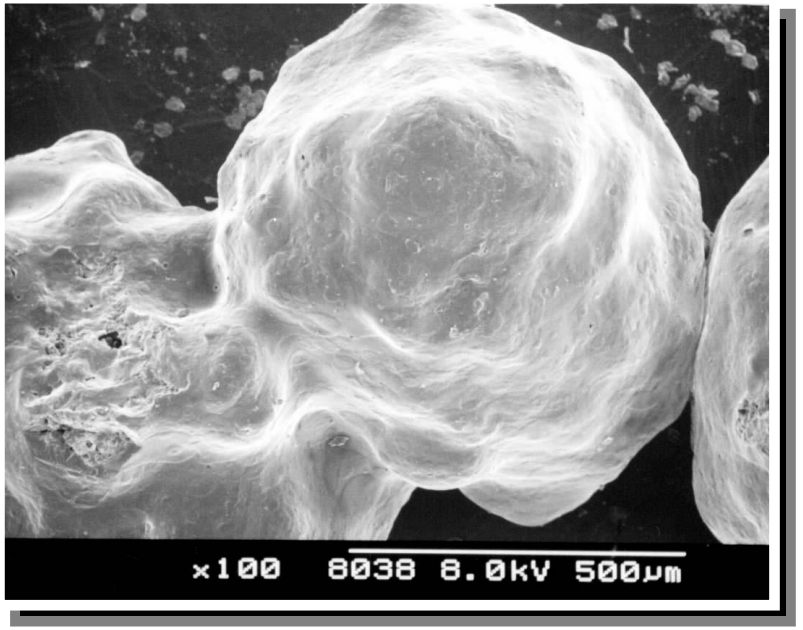


wrinkling

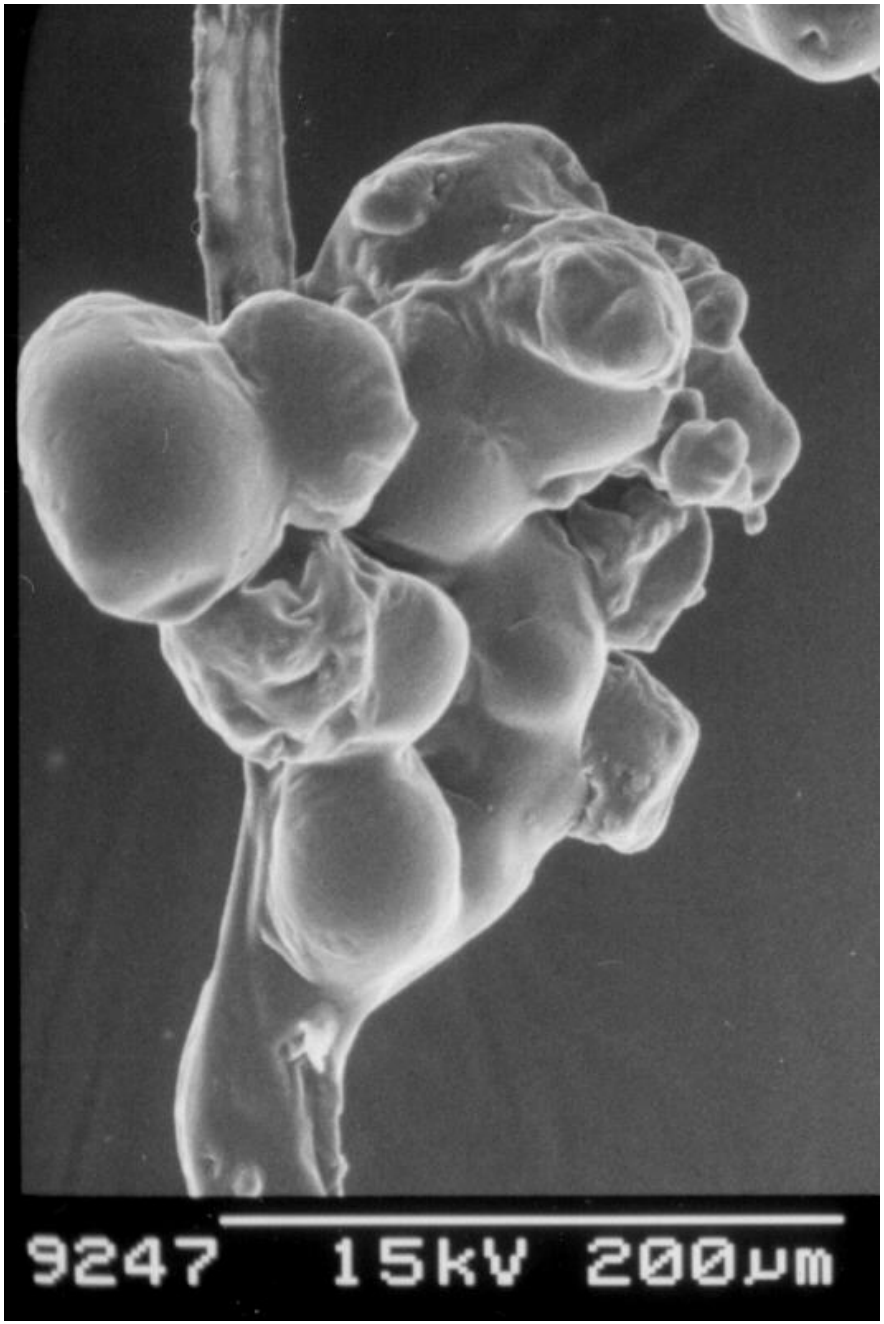
Coating defects

orange peel





twin formation



~~*Cluster of grapes?*~~

It is the result of bad pellet coating.

Good bye!