TRƯỜNG ĐẠI HỌC NÔNG LÂM TP. HỎ CHÍ MINH KHOA CƠ KHÍ – CÔNG NGHỆ BỘ MÔN MÁY SAU THU HOẠCH VÀ CHẾ BIẾN



Chương 2:

MÁY VẬN CHUYỂN LIÊN TỤC

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Survey Information

A well designed materials handling system attempts to achieve the following:

(i) Improve efficiency of a production system by ensuring the right quantity of materials delivered at the right place at the right time most economically.

- (ii) Cut down indirect labour cost.
- (iii) Reduce damage of materials during storage and movement.

(iv) Maximise space utilization by proper storage of materials and thereby reduce storage and handling cost.

- (v) Minimise accident during materials handling.
- (vi) Reduce overall cost by improving materials handling.
- (vii) Improve customer services by supplying materials in a manner convenient for handlings.
- (viii) Increase efficiency and saleability of plant and equipment with integral materials handling features.

However, the negative aspects of materials handling should also not be overlooked. These are:

- (i) Additional capital cost involved in any materials handling system.
- (ii) Once a materials handling system get implemented, flexibility for further changes gets greatly reduced.
- (iii) With an integrated materials handling system installed, failure/stoppage in any portion of it leads to increased downtime of the production system.
- (iv) Materials handling system needs maintenance, hence any addition to materials handling means additional maintenance facilities and costs.

System Concept (1)

The term "system" has many meaning depending on the field where applied. A general definition of the term could be: a complex unity formed of many often diverse parts subject to a common plan or serving a common purpose. The important characteristics of a system is that the parts, called subsystems, are interrelated and guided by an objective for which the system exists.

System Concept (2)

- In an industry, materials handling is a subsystem (or part) of the production system. Materials handling itself can also be considered to be a system whose subsystems are:
- (*i*)design or method to be adopted,
- (ii)types of materials handling equipment to be used,
- (*iii*) different operations like packing /unpacking, movement and storage involved,
- (*iv*) maintenance required for the equipment employed,

(*v*) mode of transportation by the raw materials suppliers, distributors / customers, waste / scrap collectors etc. The common objective by which the different subsystems are guided is the lowest cost solution of the materials handling system for that industry.

CHARACTERISTICS AND CLASSIFICATION OF MATERIALS (1)

Method to be adopted and choice of equipment for a materials handling system primarily depends on the type of material/s to be handled. It is, therefore, very important to know about different types of materials and their characteristics which are related to methods and equipment used for their handling.

As innumerable different materials are used and need to be handled in industries, they are classified based on specific characteristics relevant to their handling.

Basic classification of material is made on the basis of forms, which are (*i*) Gases, (*ii*) Liquids, (*iii*) Semi Liquids and (*iv*) Solids.

Following characteristics of gases, liquids and semiliquids are relevant to their handling.

For gases it is primarily pressure, high (25 psi and more) or low (less than 25 psi). Chemical properties are also important.

For liquids the relevant characteristics are density, viscosity, freezing and boiling point, corrosiveness, temperature, inflammability etc.

Examples of common industrial liquids are: water, mineral oils, acids, alkalies, chemicals etc.

Examples of common semi-liquids are: slurry, sewage, sludge, mud, pulp, paste etc.

CHARACTERISTICS AND CLASSIFICATION OF MATERIALS (3)

Gases are generally handled in tight and where required, pressure resisting containers. However, most common method of handling of large volume of gas is through pipes by the help of compressor, blower etc. This process is known as pneumatic conveying.

Liquids and semiliquids can be handled in tight or open containers which may be fitted with facilities like insulation, heating, cooling, agitating etc. as may be required by the character of the liquid. Large quantity of stable liquids/semiliquids are generally conveyed through pipes using suitable pumps, which is commonly known as hydraulic conveying.

CHARACTERISTICS AND CLASSIFICATION OF MATERIALS (4)

• Solids form the majority of materials which are handled in industrial situation. Solids are classified into two main groups: Unit load and Bulk load (materials).

• Unit loads are formed solids of various sizes, shapes and weights. Some of these are counted by number of pieces like machine parts, molding boxes, fabricated items. Tared goods like containers, bags, packaged items etc. and materials which are handled en-masses like forest products (logs), structurals, pig iron etc. are other examples of unit loads.

CHARACTERISTICS AND CLASSIFICATION OF MATERIALS (5)

(a) Shape of unit loads - (*i*) basic geometric forms like rectangular, cylindrical, pyramidal/conical and spherical; (*ii*) typical or usual forms like pallets, plate, containers, bales and sacks; (*iii*) irregular forms like objects with flat base dimension smaller than overall size, loads on rollers/wheels and uneven shapes.

(b) Position of C.G. (stability) of load.

(c) Mass of unit load in 10 steps from 0-2.5 kg to more than 5000 kg.

(d) Volume per unit in 10 steps from 0-10 cm3 to more than 10 m3.

CHARACTERISTICS AND CLASSIFICATION OF MATERIALS (6)

(e)Type of material in contact with conveying system like metal, wood, aper/cardboard, textile, rubber /plastics, glass and other materials.

(f) Geometrical shape (flat, concave, convex, irregular/uneven, ribbed etc.) and physical properties (smooth, slippery, rough, hard, elastic etc) of base surface of unit load.

(g) Specific physical and chemical properties of unit loads like abrasive, corrosive, dust emitting, damp, greasy/oily, hot, cold, fragile, having sharp edges, inflammable, explosive, hygroscopic, sticky, toxic, obnoxious, radioactive etc.

(*h*) Loads sensitive to pressure, shock, vibration, turning/tilting, acceleration/deceleration, cold, heat, light, radiation, damp etc.

CHARACTERISTICS AND CLASSIFICATION OF MATERIALS (7)

Bulk materials are those which are powdery, granular or lumpy in nature and are stored in heaps. Example of bulk materials are: minerals (ores, coals etc.), earthly materials (gravel, sand, clay etc.) processed materials (cement, salt, chemicals etc.), agricultural products (grain, sugar, flour etc.) and similar other materials.

Major characteristics of bulk materials, so far as their handling is concerned, are: lump-size, bulk weight, specific weight, moisture content, flowability (mobility of its particles), angles of repose, abrasiveness, temperature, proneness to explosion, stickiness, fuming or dusty, corrosivity,hygroscopic etc



Fig. 1.4.1. Size of a particle

CHARACTERISTICS AND CLASSIFICATION OF MATERIALS (8)

Lump size of a material is determined by the distribution of particle sizes. The largest diagonal size 'a' of a particle in mm (see Fig.1.4.1) is called the particle size. If the largest to smallest size ratio of the particles of a lumpy material is above 2.5, they are considered to be unsized.

Bulk weight or bulk density of a lumpy material is the weight of the material per unit volume in bulk. Because of empty spaces within the particles in bulk materials, bulk density is always less than density of a particle of the same material.

CHARACTERISTICS AND CLASSIFICATION OF MATERIALS (9)

Mobility not flowability of a bulk material is generally determined by its angle of repose. When a bulk material is freely spilled over a horizontal plane, it assumes a conical heap.

Classification and codification of bulk materials based on lump size, flowability, abrasiveness, bulk density and various other characteristics have been specified by the BIS specification number IS:8730:1997(3)



CHARACTERISTICS AND CLASSIFICATION OF MATERIALS (10)



CHARACTERISTICS AND CLASSIFICATION OF MATERIALS (11)

Material Characteristics	Description of characteristics with Typical Examples	Limits of Characteristics	Class
1. Lump size	Dusty material (cement)	" $a_{\rm max}$ " upto 0.05 mm	А
	Powdered material (fine sand)	"amax" upto 0.05 to 0.50 mm	В
	Granular material (grain)	"a _{max} " upto 0.5 to 0.10 mm	С
	Small sized lumpy (iron ore)	"amax" upto 10 to 60 mm	D
	Medium sized lumpy (chipped wood)	"amax" upto 60 to 200 mm	Е
	Large lump materials (boulder)	"amax" upto 200 to 500 mm	F
	Especially large lump size	"a _{max} " over 500 mm	G

2. Flowability	Very free flowing (cement, dry sand)	Angle of repose: 0°-20°	1
	Free flowing (whole grains)	Angle of repose: 20°-30°	2
	Average flowing (anthracite coal, clay)	Angle of repose: 30°-35°	3
	Average flowing (bituminous coal, ores, store)	Angle of repose: 35°-40°	4
	Sluggish (wood chips, bagasse, foundry sand)	Angle of repose:>40°	5
3. Abrasiveness	Non-abrasive (grains)		6
	Abrasive (alumina)		7
	Very abrasive (ore, slag)		8
	Very sharp (metal scraps)	Cuts belting of coveyors.	9
4. Bulk density	Light (saw, dust, peat, coke)	Upto 0.6 t/m3	Н
	Medium (wheat, coal, slag)	0.6 to 1.6 t/m ³	I
	Heavy (iron ore)	1.6 to 2.0 t/m3	J
	Very heavy	2.0 to 4.0 t/m ³	К
5. Miscellaneou	Aerates and develops fluid	(<u></u>))	L
characteristics	Contains explosive (or external) dust		М
	Sticky		N
	Contaminable, affecting use or saleability		Р
	Degradable, affecting use or saleability		Q
	Gives off harmful fumes or dust		R
	Highly corrosive		S
	Mildly corrosive		Т
	Hygroscopic		U
	Oils or chemicals present	May affect rubber products	w
	Packs under pressure		X
	Very light and fluffy (or very high flowability and dusty)	May be swept by wind	Y
	Elevated temperature		Z

Sl.No.	Material	Average Bulk Density, kg/m ³	Angle of Repose, degrees	Code*
1	Alumina	800-1040	22	B27M
2	Bauxite, crushed, 75mm and under	1200-1350		D38
3	Cement, Portland	1500	39	A27M
4	Coal, anthracite, sized	960	27	C27
5	Iron ore	1600-3200	35	D37
6	Lime, hydrated	560-720	40	
7	Rice, hulled or polished	720-768	20	B16
8	Sand, foundry, prepared	1440	39	D38
9	Slag, blast furnace, crushed	1280-1440	25	A28
10	Stone, crushed	1360-1440		-
11	Wheat	720-768	28	C26N
12	Wood chips	290-320	-	E56WY

Table 1.4.2 List of a Few Typical Bulk Materials with Codes

Phân loại

- Máy VCLT có bộ phận kéo: băng tải, xích tải, gầu tải.
- Máy VCLT không có bộ phận kéo: băng chuyền con lăn, vít tải, máng lắc, băng tải rung....
- Máy vận chuyển bằng thủy khí: dùng sức nước (không khí) để vận chuyển vật liệu.





Đặc tính của vật liệu vận chuyển:

- Vật liệu đóng kiện và bao bì: các chi tiết máy, cụm máy, hòm, thùng, kiện, túi, bao,...
- Vật liệu rời: hạt, bột, vỏ trấu, sản phẩm sau vo viên,....
- Vật liệu dạng nhão quánh: bột nhào,...







Đặc tính của vật liệu đóng kiện

- Trọng lượng của kiện
- Hình dạng và kích thước
- Loại bao bì
- Tính chất và diện tích mặt tựa
- Sự tiện lợi khi đặt hoặc treo.
- Mức độ chống lắc giật và rung.
- Các tính chất khác: nhiệt độ, khả năng gây nổ, cháy,...



Đặc tính của vật liệu rời

- Tỉ trọng
- Thành phần hạt
- Góc dốc tự nhiên
- Hệ số ma sát tĩnh và động
- Các tính chất đặc biệt: độ ẩm, tính hút ẩm, tính mài mòn, nhiệt độ,...
- Độ giòn, độ nhạy với tác dụng cơ học.



Phân loại vật liệu rời

Theo kích thước

- Cục lớn: >160 mm
- Cục trung bình: 60 160 mm
- Cục nhỏ: 10 60 mm.
- Hạt: 0,5 10 mm.
- Bụi: <0,5 mm.

Theo tính đồng nhất:

• Chưa gia công $\frac{\alpha_{max}}{\alpha_{min}}$ >2,5 • Gia công $\frac{\alpha_{max}}{\alpha_{min}}$ <2,5

Theo tỷ trọng

- Nhẹ: <= 0,6 T/m³
- Trung bình: 0,6 1,1
- Nặng: 1,1 2.

CHỌN THIẾT BỊ VẬN CHUYỂN LIÊN TỤC

- Đặc điểm của vật liệu vận chuyển.
- Năng suất yêu cầu của thiết bị.
- Phương vận chuyển.
- Chiều dài vận chuyển.
- Phương pháp bảo quản vật tại nơi chất và dỡ tải.
- Đặc tính của các quá trình gia công.
- Điều kiện tương quan bố trí các thiết bị vận chuyển.
- Các yếu tố phát sinh.

Sơ đồ vận chuyển hạt



Dây chuyền chế biến thức ăn gia súc





