The Three Biggest Food Dust Collector Problems and How to Avoid Them

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Food industry filtration problems are unique due to the basic components and inherent characteristics of most food products. In many natural products, it is not unusual to find moisture, fats or oils, inherent stickiness, electrostatics and sometimes abrasive or fibrous components. No other industry has the potential for as many problem dust filtration characteristics in the same process or product.

So how do you avoid these problems and keep your dust collection bags performing well over a longer period of time? The first and most obvious answer is that the product's normal or natural characteristics are what they are and seldom, if ever, can be changed to improve the dust collection process. The starting point for a solution lies instead with an analysis of the dust using a combination of scientific and subjective evaluations. The more scientific tests may include particle size analysis, moisture content, Kst, bulk density and others which reveal specific and measurable base data. The less scientific and more subjective observations for dust collection purposes reveal stickiness, agglomeration tendency, abrasiveness, fibrosity and likelihood of static buildup. Once the dust characteristics are known we can predict the types of problems likely to occur in the collector and, from that, avoid the consequences of those problems.

The three most commonly encountered dust collection problems in food industry dust collection are:

1. Blinding or plugging of the media
2. Poor cake release
3. Static electricity

Several of these problems are inter-related and, in some cases, may in turn cause one of the other major problems. However, we will examine them first individually and then as they relate to the other problem areas.

Blinded Media

By far the biggest single problem observed in the field is blinded or plugged filter media. The result of this problem is a high dp (pressure drop) across the collector, too frequent cleaning and heavy use of compressed air (in pulse jet collectors). In the worst cases, the draw or flow of the process may be reduced so severely that the bags must be replaced in order to keep things running and product moving.

The more general root causes of blinded or plugged filter media include dust and media mismatches, dust which is wet, sticky, oily, fatty or tends to attract moisture (hygroscopicity)and static electricity (Please note that the major parts of this article normally refer to needled felt media which would be used in a traditional pulse jet collector).

In the case of media-to-dust mismatch, the basic problem is that the efficiency of the felted media is great enough to surface separate the fine particle size of the dust. The dust progressively penetrates the depth of the felt and, over time, more dust stays in the depth felt than is cleaned out during pulse back. This permanent dust build up progressively restricts flow of the air through the media to the point of continuous cleaning and pressure drops which inch higher and higher. This condition can also be exacerbated by other dust characteristics such as the tendency to agglomerate, high moisture, oiliness or static build up.

To correct this condition, the first changes have to be made in the felt density, the fiber diameters and in development of a media which will build a filter cake on the media surface (surface load) while at the same time minimizing penetration of the depth of the media. If fats and oils are **not** present, a membrane laminate is one option to perform this surface loading effect. If the potential for fats and oils **does** exist, the best option is a well made, densely needled, scrim supported felt with finer fibers (down to micro-denier size, if necessary). Surface treatments of glazing or singeing should be added as appropriate. A third change to the media may also be the addition of a treatment using oil and water repelling compounds which coat the individual fibers. This type of treatment is discussed further in the "Cake Release" section. The key is to always identify the primary problem, dust or media, and then address that issue with the base felt design.

Poor Cake Release

Cake release, that is the removal of the dust layer from the media surface during pulse cleaning, may be another cause of poor bag performance. If a wet or oily filter cake forms on the surface of the media, there is obviously not going to be a filtration efficiency problem or any issues collecting the dust. The major difficulty is getting that wet, oily, sticky dust off the surface to allow adequate air flow.

In this situation, we address the surface of the felt itself and use a smooth, glazed (or eggshell or mirror) finish to minimize the potential for attachment by the filter cake by fusing the fibers together with a hot calender roll process. The hot calendering is done during the manufacture of the base felt. The glazed surface presents a smooth, slick surface to the aggressively agglomerating dust and helps by not restricting the cake when the bag is pulsed.

An additional enhancement to aid dust cake release is a further treatment of the felt with an oil and water repelling bath where the individual fibers throughout the felt are coated. This treatment is identical in concept to the types used in consumer carpet, upholstery and clothing applications for "spill resistance". However, the industrial grades are designed and applied for durability and long life under difficult, continuous operating conditions. These oil and water repelling treatments aggressively prevent moisture, fats and oils from inhibiting proper cake release and assist the glazed surface in providing a thorough discharge of the filter cake.

A variation of cake release problems occurs when a cellulosic food product has fibrous components in the dust. Fibrous dust generally does not cause a pressure drop problem because the filter cake is not very dense. However, removing that fibrous filter cake from the bag surface is very difficult because the fibers in the filter cake will readily attach themselves to any available stationary point on the felt surface. A fibrous dust will attach itself to the media surface, to the thread, to the cut edges of the media, to other fibrous particles, to small, solid dust cake nodules, to singed media fiber melt points and to anything else

which provides a solid base. In extreme cases, a fibrous dust will bridge between the filter bags and literally fill up the inside of the collector with fibrous filter cake.

The fibrous dust problem has a solution in the form of ultra smooth cake side surfaces on the media or in a special product from one felt manufacturer. The ultra smooth surfaces are in the form of a membrane laminate (as long as the membrane maintains its integrity) and in micro-porous, air permeable surface coatings using products such as urethane and PTFE (such as Surfcoat and Defender). In addition to allowing the necessary air flow, these coatings have very small pores which are fine enough to prevent fibrous dust from anchoring themselves to the coated media surface.

One felt manufacturer offers a product called SSR which also works well when fibrous dust is present. The concept here is that the surface of the felt is covered with sintered plastic granules which form a surface not unlike a very heavy singe. However, the melted granules are far enough from the felt's surface fibers that they prevent the fibrous dust tendrils from attaching themselves, and the surface of the SSR is heavily populated with granules, preventing penetration.

Static Electricity

The third and potentially most dangerous problem in a dust collector is the build-up of static electricity. Static build-up can cause poor cake release, can cause plugging and, worst of all, can be a cause of explosion where loss of life, injury, fire, equipment damage and lost production may result. In certain dusts, without static control, the filter cake may be attached to the bag with a strong electrical bond. This results in poor cleaning and limited cake removal. Static may also keep dust aggressively attached to the fibers in the felt, causing internal plugging or blinding in the depth of the media. In a worst case scenario, static concentration may be great enough that an arc is formed between bags and, if the aerosol is right, that arc becomes the ignition source for a dust explosion.

The solution for static in a dust collector is fairly straightforward, however. First, the collector itself, and specifically the tube sheet, must be grounded per OSHA or NFPA standards. To bleed or conduct potentially harmful static off the filter bags and out of the collector, the bag surface must be totally conductive, and the conductive bag must be in contact with the tube sheet. This last aspect is critical because in top load design (snap-in) bags a non-conductive cuff material would actually act as an insulator between the conductive bag body and the grounded tube sheet. This problem can be easily avoided by using a lightweight, but conductive, cuff felt in place of the normal cuff material.

A popular but ineffective method to conduct static off a bag surface has been the use of copper or stainless ground braid or wire sewn into or on top of the bag seam, which forms the tubular bag shape. Conductivity testing with electrical charges indicates that the metal braid will conduct static effectively, but it does not conduct or dissipate any static away from the seam. This is because all standard synthetic fibers, fabrics and felts are similarly non-conductive and, by themselves, have a very high resistivity to electrical charges. Since static is a surface phenomenon and does not "drain" like water, any static on the surface of the bag with or without ground wire will remain there. <u>The only way to effectively conduct static off the surface of a filter bag is to make the entire surface conductive.</u>

The most effective static dissipating woven filter media use stainless steel wrapped yarns in the machine direction, spaced approximately 5 - 6 mm apart. Similarly effective are needled felts with a woven scrim using stainless wrapped yarns every 5 - 6 mm apart in both machine and cross directions. When needled

properly, these felts provide resistance below 10-3 ohms, which is essentially unmeasurable and classifies the media as fully conductive. These engineered felt media have effectively replaced first generation stainless steel "blend" felts, epitropic fiber felts and felts with chemical static dissipating treatments, all of which are less durable and less effective. Once the conductive bag is properly made and installed, static will be conducted out of the collector to ground.

Filter Media Services provides consulting in selecting, designing, installing and maintaining fabric filter bags and dust collection systems.

Filter Media Services, LLC, http://www.filtermediaservices.com, is a unique filter expert, dedicated exclusively to consulting with manufacturers, converters and end users of textile based filter media. As filtration consultants and filter experts, the company also provides services relating to filter marketing and filter media use to industry associations and other groups whose members develop, market or employ filter media.

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