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Wet scrubber design pdf online template download

Unsourcesd material may be challenged and removed.Find sources: "Wet scrubber" - news - newspapers - books - scholar - JSTOR (February 2013) (Learn how and when to remove this template message) The term wet scrubber describes a variety of devices that remove pollutants from a furnace flue gas or from other gas streams. No secondary dust sources: Once particulate matter is collected, it cannot escape from hoppers or during transport. (APTI Course 415). New York: McGraw-Hill. You're Reading a Free Preview Pages 6 to 10 are not shown in this preview. Categorization Since wet scrubbers vary greatly in complexity and method of operation, devising categories into which all of them neatly fit is extremely difficult. However, most scrubbers operate over a wide range of pressure drops, depending on their specific application, thereby making this type of categorization difficult. Advantages and disadvantages For particulate control, wet scrubbers (also referred to as wet collectors) are evaluated against fabric filters and electrostatic precipitators (ESPs). An entrainment separator or mist eliminator removes any liquid droplets that may have become entrained in the flue gas. Corrosion problems: Water and dissolved pollutants can form highly corrosive acid solutions. Inlet gas characteristics and dust properties (if particles are present) are of primary importance. Gas-side pressure drop refers to the pressure difference, or pressure drop, that occurs as the exhaust gas is pushed or pulled through the scrubber, disregarding the pressure that would be used for pumping or spraying the liquid into the scrubber. Wet scrubbers can remove both gases and particulate matter. Various tower designs exist The design of wet scrubbers or any air pollution control device depends on the industrial process conditions and the nature of the air pollutants involved. Texas Commission on Environmental QualityScrubbing Liquid Characteristics (continued)Data for Venturi ScrubberThroat Dimensions (specify units):Throat Velocity (ft/sec):Superficial Gas Velocity Through Bed:On a separate sheets attach the following:Details regarding principle of operationAn assembly drawing (front and top view) of the abatement deviceclearly showing the design, size, and shape.If the device has bypasses, safety valves, etc., include in drawing and specify when suchbypasses are to be used and under what conditions.TCEQ-10181 (APDG 5954v3, Revised 06/16) Table 13This form is for use by facilities subject to air quality permit requirements andmay be revised periodically. References ~ US EPA Air Pollution Training Institute developed in collaboration with North Carolina State University, College of Engineering (NCSU) Retrieved from " Components Some components that are specific to the wet scrubbing process include: venturi scrubber spray chamber/tower cyclonic spray scrubber packed bed ejector venturi scrubber A system may include one or multiple of these components in addition to various supporting components such as: Ductwork and fan system A saturation chamber (optional) Entrainment separator or mist eliminator Pumping (and possible recycle system) Spent scrubbing liquid treatment and/or reuse system An exhaust stack A typical wet scrubbing process can be described as follows: Hot flue gas from a furnace enters a saturator (if present) where gases are cooled and humidified prior to entering the scrubbing area. Please help improve this article by adding citations to reliable sources. The gas flows through a second scrubber, a packed bed absorber, where the rest of the gases (and particulate matter) are collected. Wet scrubbers have been used in a variety of industries such as acid plants, fertilizer plants, steel mills, asphalt plants, and large power plants. Low energy devices such as spray towers are used to collect particles larger than 5 micrometers. However, in many cases, the best operating conditions for particles collection are the poorest for gas removal. Fans and ductwork move the flue gas stream through the system and eventually out the stack. Again, this distinction is not always clear since scrubbers can often be used to remove both types of pollutants. Venturi scrubbers have a minimum particle removal efficiency of 95%. U.S. Environmental Protection Agency. A wet scrubber's ability to collect small particles is often directly proportional to the power input into the scrubber. This article needs additional citations for verification. Scrubbers can be designed to collect particulate matter and/or gaseous pollutants. The droplets are then collected, the liquid dissolving or absorbing the pollutant gases. Scrubbers may be classified by pressure drop as follows: Low-energy scrubbers have pressure drops of less than 12.7 cm (5 in) of water. Any droplets that are in the scrubber inlet gas must be separated from the outlet gas stream by means of another device referred to as a mist eliminator or entrainment separator (these terms are interchangeable). Design See also: Particle collection in wet scrubbers A venturi scrubber design. 84:87-91. Control of Particulate Emissions (APTI Course 413). Perry, J. Good gas-to-liquid contact is essential to obtain high removal efficiencies in absorbers. High power requirements: High collection efficiencies for particulate matter are attainable only at high pressure drops, resulting in high operating costs. Various wet-scrubber designs are used to remove gaseous pollutants, with the packed tower and the plate tower being the most common. Difficult product recovery. Dewatering and drying of scrubber sludge make recovery of any dust for reuse very expensive and difficult. Practical process design of particulate scrubbers. In wet scrubbers, flue gases are cooled, resulting in smaller overall size of equipment. Wet scrubbers remove dust particles by capturing them in liquid droplets. Texas Commission on Environmental QualityEmission Point No. (from Flow Diagram):Model No. (if available):Name of Abatement Device:Type of Air Contaminant Controlled:Gas Stream CharacteristicsGas Stream Temperature (°F)Particulate Grain Loading (grain/scf)Particulate Distribution (by weight)Scrubbing Liquid CharacteristicsPressure at Spray Nozzle (psia):Pressure Drop Through Scrubber (inches H O):TCEQ-10181 (APDG 5954v3, Revised 06/16) Table 13This form is for use by facilities subject to air quality permit requirements andmay be revised periodically. Also, wet-dry interface areas can result in corrosion. A recirculation pump moves some of the spent scrubbing liquid back to the venturi scrubber where it is recycled and the remainder is sent to a treatment system. Chemical Engineering. Some disadvantages of wet scrubbers include corrosion, the need for entrainment separation or mist removal to obtain high efficiencies and the need for treatment or reuse of spent liquid. Water pollution problems: ash ponds, settling ponds or sludge clarifiers may be needed to meet wastewater regulations. 1978. 1995. T. In general, obtaining high simultaneous gas and particulate removal efficiencies requires that one of them be easily collected (i.e., that the gases are very soluble in the liquid or that the particles are large and readily captured), or by the use of a scrubbing reagent such as lime or sodium hydroxide. Handles high-temperature, high-humidity gas streams. No temperature limits or condensation problems can occur as in baghouses or ESPs. Minimal fire and explosion hazards: Various dry dusts are flammable. Wet scrubbers that remove gaseous pollutants are referred to as absorbers. (Ed.). The greater the number of liquid droplets that are not captured by the mist eliminator, the higher the potential emission levels. The saturator removes a small percentage of the particulate matter present in the flue gas. High-energy scrubbers have pressure drops greater than 37.1 cm (15 in) of water. In a wet scrubber, the polluted gas stream is brought into contact with the scrubbing liquid, by spraying it with the liquid, by forcing it through a pool of liquid, or by some other contact method, so as to remove the pollutants. The versatility of wet scrubbers allow them to be built in numerous configurations, all designed to provide good contact between the liquid and polluted gas stream. Some advantages of wet scrubbers over these devices are as follows: Wet scrubbers have the ability to handle high temperatures and moisture. Smaller sizes result in lower capital costs and more flexibility in site location of the scrubber. 1973. Treated scrubbing liquid is recycled back to the saturator and the packed bed absorber. Medium-energy scrubbers have pressure drops between 12.7 and 38.1 cm (5 and 15 in) of water. Richards, J. To obtain high efficiency removal of 1 micrometer (or less) particles generally requires high-energy devices such as venturi scrubbers or augmented devices such as condensation scrubbers. Fibre-reinforced plastic and dual keys are often used as most dependable materials of construction. Additionally, a properly designed and operated entrainment separator or mist eliminator is important to achieve high removal efficiencies. Semrau, K. H. Wet scrubbers can achieve high removal efficiencies for either particles or gases and, in some instances, can achieve a high removal efficiency for both pollutants in the same system. Chemical Engineers' Handbook. Wet scrubbers can neutralize corrosive gases. Relative advantages and disadvantages of wet scrubbers compared to other control devices Advantages Disadvantages Small space requirements: Scrubbers reduce the temperature and volume of the unsaturated exhaust stream. Next, the gas enters a venturi scrubber where approximately half of the gases are removed. Wet scrubbers can also be categorized by the manner in which the gas and liquid phases are brought into contact. Bibliography Bethes, R. 1977. Another way to classify wet scrubbers is by their use - to primarily collect either particulates or gaseous pollutants. Scrubbers for particle collection are usually categorized by the gas-side pressure drop of the system. Also, the resultant scrubbing liquid must be treated prior to any ultimate discharge or being reused in the plant. Proper construction materials are very important. Texas Commission on Environmental QualityEmission Point No. (from Flow Diagram):Model No. (if available):Name of Abatement Device:Type of Air Contaminant Controlled:Gas Stream CharacteristicsGas Stream Temperature (°F)Particulate Grain Loading (grain/scf)Particulate Distribution (by weight)Scrubbing Liquid CharacteristicsPressure at Spray Nozzle (psia):Pressure Drop Through Scrubber (inches H O):TCEQ-10181 (APDG 5954v3, Revised 06/16) Table 13This form is for use by facilities subject to air quality permit requirements andmay be revised periodically. Ability to collect both gases and particulate matter. The mist eliminator for a venturi scrubber is often a separate device called a cyclonic separator A packed bed tower design where the mist eliminator is built into the top of the structure. 5th ed. These categories are given in Table 2.[1] Categories of wet collectors by energy source used for contact Wet collector Energy source used for gas-liquid contact Gas-phase contacting Liquid-phase contacting Wet film Combination Liquid phase and gas phase Mechanically aided Gas stream Liquid stream Liquid and gas streams Energy source: Liquid and gas streams Mechanically driven rotor Material of construction and design Corrosion can be a prime problem associated with chemical industry scrubbing systems. Air Pollution Control Technology. R. Control of Gaseous Emissions. M. If the gas stream contains both particulate matter and gases, wet scrubbers are generally the only single air pollution control device that can remove both pollutants. Scrubbers are designed to use power, or energy, from the gas stream or the liquid stream, or some other method to bring the pollutant gas stream into contact with the liquid. New York: Van Nostrand Reinhold. Therefore, vessel sizes, including fans and ducts downstream, are smaller than those of other control devices. Using water eliminates the possibility of explosions.

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