ACTIVE CLOUDWATER COLLECTOR

BACKGROUND OF THE INVENTION

This invention relates to the collection of fog water or cloud water and, more particularly, to the collection of cloud water by a device wherein cloud droplets impact upon Teflon strands and are funneled into a sample bottle.

Under supersaturated conditions in the atmosphere, fog droplets form by activation of condensation nuclei and rapidly grow to diameters of 1 to about 100 microns. Recent reports of extremely high acidities in fogs, and clouds intercepting mountain slopes, have raised concern regarding related environmental consequences. Air quality control agencies in areas exposed to acidic fog have expressed the need to establish networks of sites monitoring the chemical composition of fog on a routine basis.

Various types of fog water collectors have been designed, including use of a filter medium to capture the water on impaction and dripping from large obstacles, such as sails.

U.S. Pat. No. 3,889,532 discloses apparatus for collecting fog water consisting of a slotted rotatable tube. The tube is rotated, and fog droplets are collected by impaction on the tube. Centrifugal force causes the water to flow outward toward the ends of the tube where it is collected in small vials. However, the device of this patent presents safety problems and is not suitable for automation.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an improved cloud water collector which efficiently collects fog droplets in the 1 to 100 micron diameter range.

Another object of the invention is the provision of a cloud water collector of the above type capable of preserving the size and chemical composition of fog droplets through all stages of collection.

A still further object is to provide a cloud water collector which rapidly collects relatively large amounts of liquid cloud water for wet chemical analysis.

Yet, another object is to provide a cloud water collector which is inexpensive to construct, is reliable and requires minimal maintenance.

Another object is the provision of an efficient cloud water collector which can be automated and including means for automating such collector.

A still further object is to provide an automated sampler, which is particularly useful in combination with the above-noted cloud water collector, or which can be used for collection of rain water samples.

According to the invention, there is provided a cloud water collector comprised of a sampler duct, e.g., in the form of a square box, open at both ends, and having a fan at the back of the duct. The fan draws the cloud through the sampler from the front of the duct, and the droplets in the cloud are impacted on Teflon (polytetrafluoroethylene or a copolymer of tetrafluoroethylene and hexafluoropropylene) strands or filaments which are strung in the form of a screen on a frame. The screen formed of the Teflon strands is inclined at an acute angle, preferably about 35° from vertical, facing the front of the duct.

The droplets in the cloud impacting upon the Teflon strands of the screen are drawn down by both the air drag and by gravity to the bottom of the screen where the water droplets accumulate and are diverted to a sample bottle, and the collected bottle of water is then analyzed chemically.

In preferred practice, the Teflon strand diameter, the spacing of the strands forming the screen, and the angle of the screen have values which provide efficient and rapid collection of fog droplets in the 1 to 100 micron size range while avoiding collection of the sub-micron aerosol particles. Also, in preferred practice, a honeycomb element is provided between the fan and the screen of Teflon strands, to straighten the flow of the sample cloud throuoh the duct and provide uniform flow of the cloud sample across the duct and through the Teflon screen, to improve the performance of the collector.

The cloud water collector of the invention is easily constructed, inexpensive, and operates in a reliable manner.

The cloud water collector of the invention can be modified for automating the device so as to automatically collect successive cloud water samples. The automating means comprises a motor-driven turntable which holds a plurality of sample bottles. The cloud water sample provided by the cloud water collector is discharged into a reservoir having a liquid level sensor. When the reservoir is filled to the predetermined level, the sensor actuates a valve to open same and discharge the sample from the reservoir into one of the bottles on the turntable. The valve closes and the turntable then rotates to index the next bottle beneath the reservoir and the operation is repeated to fill the latter bottle with additional sample cloud water provided by the cloud water collector.

Alternatively, a timer can be employed instead of a liquid level sensor, which actuates a valve to discharge the cloud water sample from the reservoir into the bottle below the reservoir, when a pre-set time interval has elapsed. If desired, a combination of liquid level sensing and timer means can be employed, as described in greater detail below.

The automation device, per se, can also be employed for automatically collecting rain water samples instead of cloud water samples. When so employed, rain water is collected in a funnel and then directed to the reservoir from which it is automatically discharged into the sample bottles in the manner noted above.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be more clearly understood by reference to the preferred embodiments set forth hereinafter, taken in conjunction with the accompanying drawings, wherein:

FIG. **1** is a side elevational view of a preferred cloud water collector according to the invention;

FIG. **1***a* is an enlarged elevational view of the front portion of the device of FIG. **1**, showing the inclined screens formed of Teflon strands for collecting cloud water droplets;

FIG. **2** is a front view of the device of FIG. **1**, taken on line **2**—**2** of FIG. **1**, with the Teflon screens removed;

FIG. **3** is a rear view of the device of FIG. **1**, taken on line **3**—**3** of FIG. **1**, with the fan removed;

FIG. **4** is an elevational view of one of the screens of Teflon strands shown in FIG. **1***a*;

FIG. **4***a* is a side view of the Teflon screen of FIG. **4**;