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System and Method to Control Particle Deposition on a Filter Membrane

Abstract

Embodiments relate to a sampler component. The sampler component includes a chamber configured to allow fluid to flow there-through, a filter configured to remove particles or contaminants from the fluid as it passes through the chamber and capture said particles or contaminants on the filter, and a apertured-member including at least one aperture. The apertured-member has zero-or low-fluid permeability to prevent the flow of fluid there-through. Fluid freely passes through the at least one aperture and particles or contaminants are deposited on the filter in the area of the at least one aperture.

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Background/Summary

TECHNICAL FIELD

[0001] Embodiments can relate to a sampler and a method of sampling that facilitates control of particle deposition and minimizes particle losses by placing a thin disc with an aperture between a filter and a filter support of a sampler. Techniques described herein can facilitate use of the disc-filter arrangement in any existing sampler design—i.e., an existing sampler can be retrofitted with the disc-filter arrangement.

BACKGROUND

[0002] To monitor the air quality and possible health effects of airborne contaminants, particle-laden air is drawn through a thin membrane filter that can be analyzed later to find particle mass concentration and chemical composition. A relatively simple weighing procedure is often used to find particle mass, while different analytical techniques are available to determine the chemical composition of collected particles. These latter techniques may be time-consuming and complicated, and in many situations may require acid digestion of the filter.

[0003] Methods are available that allow direct-on-filter elemental analysis, such as X-ray fluorescence (XRF), instrumental neutron activation analysis (INAA), Fourier-transform infrared spectroscopy (FTIR), and others. In some instances, even the mass of collected particulate matter can be found via measuring light absorption by material collected on the filter. A significant benefit of direct-on-filter methods is that they can provide much quicker results. In most situations, only part of the filter is being analyzed.

[0004] Therefore, it can be important to have the most uniform deposits possible and preferably have particles deposited in the smallest area possible. In addition, it can be important to ensure that all particles entering the sampler are deposited on a filter with minimal particle losses on the internal walls of the sampler.

[0005] Conventional samplers and sample methods can be appreciated from: [0006] 1. Baron, P. A., "Factors Affecting Aerosol Sampling," NIOSH Manual of Analytical Methods (NMAM), 5th Edition, 2016. [0007] 2. Lee, T., Lee, L., Cauda, E., Hummer, J., & Harper, M. "Respirable Size-Selective Sampler for End-of-Shift Quartz Measurement: Development and Performance," Journal of Occupational and Environmental Hygiene, 14(5), 2017, pp. 335-342. [0008] 3. Baron, P. A., "Personal Aerosol Sampler Design: A Review," Applied Occupational and Environmental Hygiene, 13(5), 1998, pp. 313-320. [0009] 4. Blackford, D. B., Harris, G. W., & Revell, G., "The reduction of dust losses within the cassette of the SIMPEDS personal dust sampler," Annals of Occupational Hygiene, 29, 1985, pp. 169-180.

[0010] Samplers have been designed to achieve the above-mentioned desired area of particle deposition by restricting particle-laden air upstream of the filter. Other samplers have been designed with a larger flange downstream of the filter. Some samplers include a special filter holder to decrease particle losses on their inner walls. Yet, conventional samplers and sampling methods tend to be complex, costly, and inefficient.

SUMMARY OF THE INVENTION

[0011] Embodiments can relate to a sampler and a method of sampling that allows for control of particle deposition. The apparatus and method can also minimize particle losses by placing a thin disc with an aperture between a filter and a filter support of the sampler device. Embodiments of the technique disclosed herein can facilitate use of the apertured-disc in any existing sampler. This disc can be made of material with low or zero air permeability. The aperture can be round or any other shape. A number of apertures can be used to create several deposits on a single filter, which can allow for application of different analytical techniques to different deposits.

[0012] The methods described above can also be used to "focus" several streams of aerosol into a single deposit. This method can be particularly beneficial for parallel particle impactor (PPI) style samplers (see e.g., U.S. Pat. No. 7,073,402). Due to its unique design of combining four impactors arranged in parallel, particles are deposited on a PPI filter mainly in four small distinct spots. Such

deposition is not suitable for direct-on-filter analysis. Using the methods and apparatuses disclosed herein, however, particles or contaminants deposited on the PPI filter can be focused onto a small round area. Consequently, analysis of collected material can be performed directly on the filter.
[0013] An exemplary embodiment can relate to a sampler component. The sampler component can include a chamber configured to allow fluid to flow there-through. The sampler component can include a filter configured to remove particles or contaminants from the fluid as it passes through the chamber and capture the particles or contaminants on the filter. The sampler component can include a apertured-member including at least one aperture. The apertured-member can have zero- or low-fluid permeability to prevent the flow of fluid there-through. Fluid can freely pass through the at least one aperture and particles or contaminants are deposited on the filter in the area of the at least one aperture.
[0014] In some embodiments, the sampler component can be configured as a part for a fluid impactor device.
[0015] In some embodiments, the fluid is air.
[0016] In some embodiments, the chamber can include a fluid inlet and a fluid outlet.
[0017] Fluid can flow through the chamber in a direction from the fluid inlet to the fluid outlet. The filter can be located within the chamber. The apertured-member can be located within the chamber. The filter's location can be more proximate the fluid inlet than the apertured-member's location; and/or b) the apertured-member's location can be more proximate the fluid inlet than the filter's location.
[0018] In some embodiments, the filter can be adjacent the apertured-member.
[0019] In some embodiments, the filter can be in physical contact with the apertured-member.
[0020] In some embodiments, the filter can include a plurality of filters.
[0021] In some embodiments, the plurality of filters can include a first filter and a second filter. A configuration of the first filter can be different from a configuration of the second filter.
[0022] In some embodiments, the apertured-member can include a plurality of apertured-members.
[0023] In some embodiments, the plurality of apertured-members can include a first apertured-member and a second apertured-member. A configuration of the first apertured-member can be different from a configuration of the second apertured-member.
[0024] In some embodiments, the at least one aperture can be round, square, rectangular or triangular in shape.
[0025] In some embodiments, the at least one aperture can include a first aperture and a second aperture. A size of the first aperture can be different from a size of the second aperture. A shape of the first aperture can be different from a shape of the second aperture.
[0026] An exemplary embodiment can relate to a method of capturing particles or contaminants. The method can involve causing or allowing a fluid to flow through a sampler structure, wherein. The sampler structure can include a filter configured to remove particles or contaminants from the fluid as it flows through the sampler structure and capture said particles or contaminants on the filter. The sampler structure can include a apertured-member having at least one aperture. The apertured-member can have zero-or low-fluid permeability to prevent the flow of fluid there-through. Fluid can freely pass through the at least one aperture and particles or contaminants are deposited on the filter in the area of the at least one aperture. A region of the filter adjacent the at least one aperture can be a filter-aperture region. A region of the filter adjacent non-apertured portions of the apertured-member can be a filter-member region. Particles or contaminants can be captured on the filter in the filter-aperture region at a concentration that is greater than particles or contaminants captured on the filter in the filter-member region. In addition, or in the alternative, particles or contaminants can be captured on the filter in the filter-aperture region at a rate that is greater than particles or contaminants captured on the filter in the filter-member region.
[0027] In some embodiments, the sampler structure can include a fluid inlet and a fluid outlet. The filter's location can be more proximate the fluid inlet than the apertured-member's location. The

method can involve causing or allowing fluid flowing through the sampler structure to force the filter in a direction towards the apertured-member.

[0028] In some embodiments, the sampler structure can include a chamber, a fluid inlet, and a fluid outlet. The method can involve causing or allowing fluid flowing through the sampler structure from the fluid inlet to the fluid outlet to make physical contact with the filter before making physical contact with the apertured-member, thereby reducing or eliminating particles or contaminants being deflected to a sidewall of the chamber.

[0029] Other details, objects, and advantages of the present invention will become apparent as the following description of certain exemplary embodiments thereof proceeds.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0030] The above and other objects, aspects, features, advantages, and possible applications of embodiments of the present innovation will be more apparent from the following more particular description thereof, presented in conjunction with the following drawings. Like reference numbers used in the drawings may identify like components.

[0031] FIG. **1** is a schematic of an exemplary sampler component for an embodiment in which the filter is placed on a top of the apertured-member.

[0032] FIG. **2** is a schematic of an exemplary sampler component for an embodiment in which the filter is placed on a bottom of the apertured-member.

[0033] FIG. **3** is an exemplary filter showing particles or contaminants deposited in a filter when no apertured-membrane is used.

[0034] FIG. **4** shows a single apertured-member arrangement along with a particle or contaminant deposition formation on a filter when used in conjunction with the same, and a plural apertured-member arrangement along with a particle or contaminant deposition formation on a filter when used in conjunction with the same.

[0035] FIG. **5** is an exemplary sampler component.

DETAILED DESCRIPTION OF THE INVENTION

[0036] The following description is of exemplary embodiments and methods of use that are presently contemplated for carrying out the present invention. This description is not to be taken in a limiting sense, but is made merely for the purpose of describing the general principles and features of various aspects of the present invention. The scope of the present invention is not limited by this description.

[0037] Referring to FIGS. **1**-**2**, an exemplary embodiment can relate to a sampler component **100**. The sampler component **100** can be a component of a sampler used to collect particles (e.g., particulate matter, contaminants, viruses, microbes, etc.). For example, the sampler can be a fluid impactor device—see e.g., U.S. Pat. No. 7,073,402 which is incorporated herein by reference in its entirety. The particles can be collected for later analysis. The sampler can be used to collect the particles that are being carried in a fluid (e.g., a liquid, a gas, or a mixture of both). In an exemplary embodiment, the fluid is air. The present disclosure may refer to the particles as contaminants, but it is understood that embodiments are not necessarily limited to collecting contaminants. For instance, the particles may be desired and the collection is done to sequester them for later use, determine a representative concentration of them being carried by the fluid, etc.

[0038] The sampler has a sampler component **100** through which particle-containing fluid is forced through or allowed to pass through. The means for forcing or allowing fluid to pass through can be a differential pressure generator **130** (e.g., gravity fed system, a pump, fan blower, etc.)—e.g., the differential pressure generator **130** can generate a fluid flow stream **126** of the particle-containing fluid. It is in this sampler component **100** that the particles are collected from the fluid.

[0039] The sampler component **100** can include a chamber **102** configured to allow fluid to flow there-through. For instance, the sampler component **100** can include a housing **104** having a top **106**, a bottom **108**, sidewalls **110**, one or more fluid inlets **112** formed in the top **106**, and one or more fluid outlets **114** formed in the bottom **108**. The housing **104** can be made of rigid material, such as metal, metal alloy, plastic, ceramic, etc. The housing **104** can form a volume of space that is the chamber **102**. The inner surfaces of the housing **104** can form a chamber top **106**, chamber bottom **108**, and chamber sidewalls **110**. Fluid flows in the inlet(s) **112**, through the chamber **102**, and out the fluid outlet(s) **114** via a fluid flow stream **126**. There can be an individual fluid flow stream **126** for each individual inlet **112**. The number of fluid inlets **112** can be the same as or different from the number of fluid outlets **114**. A shape and arrangement of an inlet(s) **112** can be the same as or different from a shape or arrangement of a fluid outlet(s) **114**. Then placement or location of a fluid inlet(s) **112** in the housing top **106** can be such that it/they co-register (align or be co-axial) with or it/they do not co-register with the placement or location of a fluid outlet(s) **114**.

[0040] The sampler component can include a filter **116** configured to remove particles or contaminants from the fluid as it passes through the chamber **102** and capture the particles or contaminants on the filter **116**. The filter **116** can be a fiber material, woven material, non-woven material, etc. While it is contemplated for the sampler component **100** to have one filter **116**, it is understood that more than one filter **116** can be used. For instance, the sampler component **100** can have multiple filters **116** in a stacked formation, multiple filters **116** in a laterally spaced formation, multiple filters **116** in baffle-like formation, multiple filters **116** in a herringbone formation, a filter **116** for each fluid flow stream **126**, etc. The plurality of filters **116** can include a first filter **116**, a second filter **116**, etc. A configuration (e.g., type of material, shape, thickness, flow rate, flux, filter efficiency, sieve or mesh size, etc.) of the first filter **116** can be the same as or different from a configuration of the second filter **116**.

[0041] It is contemplated for the filter(s) **116** to span a cross-section of the chamber **102** so as to prevent any fluid from flowing to the fluid outlet(s) **114** without having to flow first through the filter(s) **116**. In an exemplary embodiment, the chamber **102** has a circular cross-section, and thus the filter **116** is a member having a circular profile, wherein the circular profile matches (or at least substantially matches) the circular cross-section of the chamber **102**. Thus, the edges of the filter **116** are adjacent or abut against the chamber sidewalls **110**. It is contemplated for the filter **116** to be a planar member. Thus, with the example of the filter **116** having a circular profile, the filter **116** can be a disc-shaped member.

[0042] The sampler component **100** can include an apertured-member **118**—e.g., the apertured-member **118** can have one or more apertures **120**. The apertured-member **118** can be configured to have zero-or low-fluid permeability to prevent the flow of fluid there-through, with the exception of through the aperture(s) **120**. The apertured-member **118** can be made of metal, metal alloy, plastic, ceramic, etc. For instance, fluid can freely pass through the aperture(s) **120** of the apertured-member **118** so that particles can be deposited on the filter **116** in an area of the filter **116** corresponding to (e.g., aligned with) aperture(s) **120** (e.g., filter-aperture region **122**).

[0043] While it is contemplated for the sampler component **100** to have one apertured-member **118**, it is understood that more than one apertured-member **118** can be used. For instance, a plurality of apertured-members **118** can be used and include a first apertured-member **118**, a second apertured-member **118**, etc. A configuration (e.g., type of material, size, thickness, number, size, or shape (e.g., round, square, rectangular, triangular, etc.) of apertures, etc.) of the first apertured-member **118** can be the same as or different from different from a configuration of the second apertured-member **118**.

[0044] Any apertured-member **118** can have any number of apertures **120**. For instance, an apertured-member **118** can have a first aperture **120**, a second aperture **120**, etc. A size or shape of the first aperture **120** can be the same as or different from a size or shape of the second aperture **120**.

[0045] It is contemplated for the apertured-member **118** to span a cross-section of the chamber **102** so as to prevent any fluid from flowing to the fluid outlet(s) without having to flow first through the aperture(s) **120** of the apertured-member **118**. In an exemplary embodiment, the chamber **102** has a circular cross-section, and thus the apertured-member **118** is a member having a circular profile, wherein the circular profile matches (or at least substantially matches) the circular cross-section of the chamber **102**. Thus, the edges of the apertured-member **118** are adjacent or abut against the chamber sidewalls **110**. It is contemplated for the apertured-member **118** to be a planar member. Thus, with the example of the apertured-member **118** having a circular profile, the apertured-member **118** can be a disc-shaped member.

[0046] The housing **104** can include a support structure **128** configured to hold or retain the filter(s) **116** and/or apertured-member(s) **118** in place. The support structure **128** can be a shelf-like structure formed in the sidewall **110**, a tab-like structure extending or protruding from the sidewall **110**, a recess formed in the sidewall **110** or bottom **108**, etc. upon or within which the filter(s) **116** and/or apertured member(s) **118** rest. In addition, or in the alternative, the support structure **128** can be a plate, grate, grid, etc. attached to the housing **104** or rested upon or within the formations discussed above, wherein the filter(s) **116** and/or apertured member(s) **118** rest upon that plate, grate, grid, etc.

[0047] In an exemplary embodiment, the chamber **102** can include a fluid inlet **112** and a fluid outlet **114**. Fluid can flow through the chamber **102** in a direction from the fluid inlet **112** to the fluid outlet **114**. The filter **116** can be located within the chamber **102**. The apertured-member **118** can be located within the chamber **102**. It is contemplated for the filter **116** to be adjacent the apertured-member **118**. For instance, filter **116** can be in physical contact with the apertured-member **118**. The filter's **116** location can be more proximate the fluid inlet **112** than the apertured-member's **118** location. Alternatively, or in addition (if more than one filter **116** and/or apertured-member **118** is used), the apertured-member's **118** location can be more proximate the fluid inlet **112** than the filter's **116** location.

[0048] An exemplary embodiment can relate to a method of capturing particles or contaminants. The method can involve causing or allowing a fluid to flow through a sampler structure (e.g., a sampler component **100**). The sampler structure **100** can include a filter **116** configured to remove particles or contaminants from the fluid as the fluid flows through the sampler structure **100**. This can cause or allow the sampler structure **100** to capture the particles or contaminants on the filter **116**. The sampler structure **100** can include an apertured-member **118** having at least one aperture **120**. The apertured-member **118** can have zero-or low-fluid permeability to prevent the flow of fluid there-through, except through the aperture(s) **120**. A region(s) of the filter **116** adjacent the aperture(s) **120** can be referred to herein as a filter-aperture region(s) **122**. A region(s) of the filter **116** adjacent non-apertured portions of the apertured-member **118** can be referred to herein as a filter-member region(s) **124**. Fluid can freely pass through the aperture(s) **120** and particles or contaminants can be deposited on the filter **116** in an area of the filter **116** corresponding to (e.g., aligned with) aperture(s) **120** (e.g., filter-aperture region **122**).

[0049] Referring to FIGS. **3-5**, particles or contaminants can be captured on the filter **116** in the filter-aperture region(s) **122** at a concentration that is greater than particles or contaminants captured on the filter **116** in the filter-member region(s) **124**. In addition, or in the alternative, particles or contaminants can be captured on the filter **116** in the filter-aperture region(s) **122** at a rate that is greater than particles or contaminants captured on the filter **116** in the filter-member region(s) **124**. This effect can be explained via an example. Assume a configuration in which the sampler component **100** has one fluid inlet **112**, one fluid outlet **114**, one filter **116**, and one apertured-member **118**, wherein the apertured-member **118** has a single aperture **120** formed at a center location of the apertured-member **118**. Further assume that the filter **116** is placed on top of the apertured-member **118** (e.g., the filter **116** is more proximate the fluid inlet **112** than the apertured-member **118** is). Thus, in operation, the fluid flow stream **126** enters the fluid inlet **112** and impinges the filter **116**. The fluid flow stream **126** stays concentrated or collimated to the filter **116** at the filter filter-aperture region **122** because this is the path of least resistance. Thus, a fluid flow channel is formed through the filter **116** at the filter-aperture region **122**. Filtration of the particles occurs mainly at the filter-aperture region **122**.

[0050] FIG. **3** shows is an exemplary filter **116** with particles deposited when no apertured-member **118** is used. The dispersed nature of the particle deposition can be seen, as compared to the more focused particle depositions shown in FIGS. **4** and **5**. In FIG. **3**, the outer rim or edge of the filter **116** was covered by the chamber sidewall **110**, and thus no particles were deposited at the rim/edge. FIG. **4** shows a single apertured-member **118** arrangement along with a particle or contaminant deposition on a filter **116** when used in conjunction with the same, and a plural apertured-member **118** arrangement along with a particle or contaminant deposition on a filter **116** when used in conjunction with the same. The images clearly show a high concentration of captured particles due to the apertured-member **118**. FIG. **5** shows particle deposit formation on the filter **116** when no apertured-member **118** is used, and particle deposit formation on the filter **116** when used in conjunction with an apertured-member **118**. When no apertured-member **118** is used, particles deposit on the filter **116** in a dispersed manner and with little concentration at any area of the filter **116**. When an apertured-member **118** is used, particles deposit on the filter **116** in a concentrated manner at the filter-aperture region **122**.

[0051] With the filter **116** being placed on top of the apertured-member **118** (e.g., the filter **116** is more proximate the fluid inlet **112** than the apertured-member **118** is), the impinging fluid on the filter **116** can generate a force vector to force the filter **116** against the apertured-member **118** (e.g., force the filter **116** in a direction towards the apertured-member **118**). This can be advantageous by reducing or eliminating any separation between the filter **116** and the apertured-member **118**. Generally, the less space that exists between the filter **116** and the apertured-member **118**, the better in regard to efficiency and efficacy of operation. For instance, a space formation can alter the formation of the fluid flow channel—e.g., cause a more dispersed fluid flow through the filter **116**.

[0052] Not only does a well-defined fluid flow channel assist in improving efficiency in efficacy of particle capture, but it also forms a highly concentrated particle containment area of the filter **116**—e.g., the particles are captured in a high-concentration at the filter-aperture region **122**. This is beneficial from an analytical perspective because it is generally more desirous to have high concentrations for sample analysis. Without the apertured-member **118**, the particles would be rather dispersed throughout the footprint of the filter **116**.

[0053] The well-defined fluid flow channel also reduces or eliminates an adverse fluid flow (e.g., a whirl formation, a fluid redirection flow, etc.) of fluid within the chamber **102**. This adverse fluid flow tends to cause particles to be deflected to and deposited on inner surfaces of the housing **104** forming the chamber **102** (e.g., they are deposited on the chamber top **106**, chamber sidewalls **110**, etc.).

[0054] As discussed above, there can be any number of fluid inlets **112**, fluid outlets **114**, and apertures **120** in the apertured-member **118**. A user can design the sampler component **100** to generate distinct fluid flow streams **126** so as to cause distinct particle deposition formations on the filter **116**. With several distinct and concentrated particle deposition formations, one can apply the same or different analytical technique to analyze each deposit formation.

[0055] It should be understood that modifications to the embodiments disclosed herein can be made to meet a particular set of design criteria. For instance, the number of or configuration of components or parameters may be used to meet a particular objective.

[0056] It will be apparent to those skilled in the art that numerous modifications and variations of the described examples and embodiments are possible in light of the above teachings of the disclosure. The disclosed examples and embodiments are presented for purposes of illustration only. Other alternative embodiments may include some or all of the features of the various embodiments disclosed herein. For instance, it is contemplated that a particular feature described,

either individually or as part of an embodiment, can be combined with other individually described features, or parts of other embodiments. The elements and acts of the various embodiments described herein can therefore be combined to provide further embodiments.
[0057] It is the intent to cover all such modifications and alternative embodiments as may come within the true scope of this invention, which is to be given the full breadth thereof. Additionally, the disclosure of a range of values is a disclosure of every numerical value within that range, including the end points. Thus, while certain exemplary embodiments have been discussed and illustrated herein, it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practiced within the scope of the following claims.

Claims

1. A sampler component, comprising: a chamber configured to allow fluid to flow there-through; a filter configured to remove particles or contaminants from the fluid as it passes through the chamber and capture said particles or contaminants on the filter; a apertured-member including at least one aperture, wherein: the apertured-member has zero-or low-fluid permeability to prevent the flow of fluid there-through; and fluid freely passes through the at least one aperture and particles or contaminants are deposited on the filter in the area of the at least one aperture.
2. The sampler component of claim 1, wherein: the sampler component is configured as a part for a fluid impactor device.
3. The sampler component of claim 1, wherein: the fluid is air.
4. The sampler component of claim 1, wherein: the chamber includes a fluid inlet and a fluid outlet; fluid flows through the chamber in a direction from the fluid inlet to the fluid outlet; the filter is located within the chamber; the apertured-member is located within the chamber; and at least one of: the filter's location is more proximate the fluid inlet than the apertured-member's location; or the apertured-member's location is more proximate the fluid inlet than the filter's location.
5. The sampler component of claim 4, wherein: the filter is adjacent the apertured-member.
6. The sampler component of claim 5, wherein: the filter is in physical contact with the apertured-member.
7. The sampler component of claim 1, wherein: the filter comprises a plurality of filters.
8. The sampler component of claim 7, wherein: the plurality of filters includes a first filter and a second filter; and a configuration of the first filter is different from a configuration of the second filter.
9. The sampler component of claim 1, wherein: the apertured-member comprises a plurality of apertured-members.
10. The sampler component of claim 9, wherein: the plurality of apertured-members includes a first apertured-member and a second apertured-member; a configuration of the first apertured-member is different from a configuration of the second apertured-member.
11. The sampler component of claim 1, wherein the at least one aperture is round, square, rectangular or triangular in shape.
12. The sampler component of claim 1, wherein: the at least one aperture includes a first aperture and a second aperture; and a size of the first aperture is different from a size of the second aperture; and a shape of the first aperture is different from a shape of the second aperture.
13. A method of capturing particles or contaminants, the method comprising: causing or allowing a fluid to flow through a sampler structure, wherein: the sampler structure includes a filter configured to remove particles or contaminants from the fluid as it flows through the sampler structure and capture said particles or contaminants on the filter; the sampler structure includes a apertured-member having at least one aperture, wherein: the apertured-member has zero-or low-fluid permeability to prevent the flow of fluid there-through; and fluid freely passes through the at least one aperture and particles or contaminants are deposited on the filter in the area of the at least one

aperture; a region of the filter adjacent the at least one aperture is a filter-aperture region, and a region of the filter adjacent non-apertured portions of the apertured-member is a filter-member region; wherein: particles or contaminants are captured on the filter in the filter-aperture region at a concentration that is greater than particles or contaminants captured on the filter in the filter-member region; and/or particles or contaminants are captured on the filter in the filter-aperture region at a rate that is greater than particles or contaminants captured on the filter in the filter-member region.

14. The method of claim 13, wherein the sampler structure includes a fluid inlet and a fluid outlet, and the filter's location is more proximate the fluid inlet than the apertured-member's location, the method further comprising: causing or allowing fluid flowing through the sampler structure to force the filter in a direction towards the apertured-member.

15. The method of claim 13, wherein the sampler structure includes a chamber, a fluid inlet, and a fluid outlet, the method further comprising: causing or allowing fluid flowing through the sampler structure from the fluid inlet to the fluid outlet to make physical contact with the filter before making physical contact with the apertured-member, thereby reducing or eliminating particles or contaminants being deflected to a sidewall of the chamber.