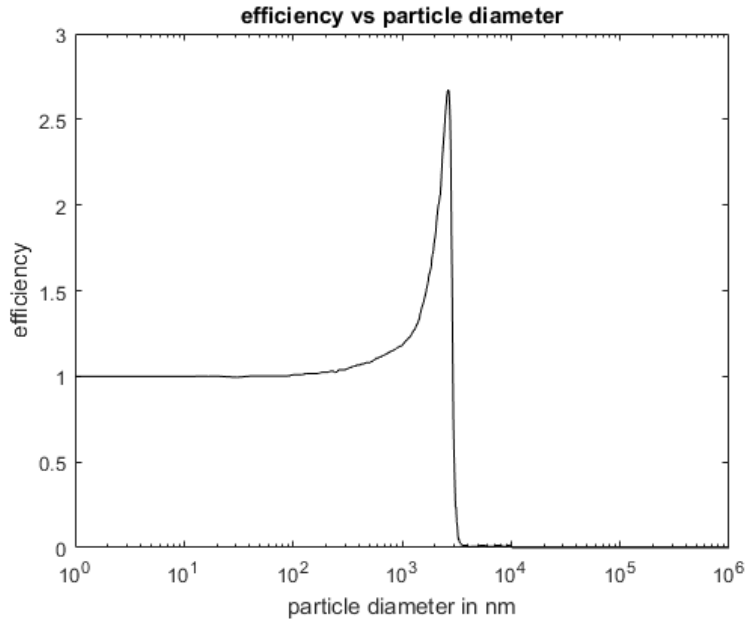
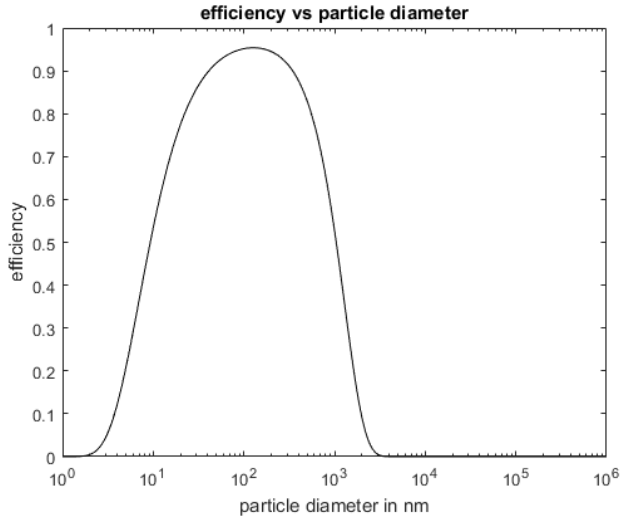
AEC (aerosol efficiency calculator) Users' Brief Introduction

Aerosol efficiency calculator contains current efficiency data or efficiency calculation of different samplers, tubing sections and instruments. Here are some introductions of how to use it:

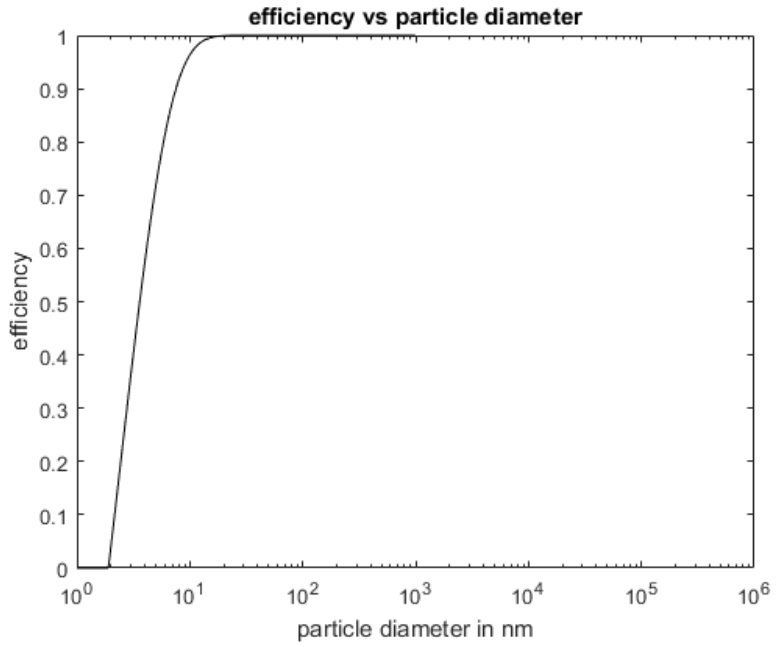
1. AEC still keep the basic function of aerosol function that can calculate some parameters of aerosol. We also add more parameters in the calculation. Type in AEC ('Dp_nm', 100) give you several related parameters of particle size of 100 nm. NOTE:
    1. Some parameters calculate based on some the default value which you can make change.
    2. AEC can calculate not just one particle, but several different sizes of particle. Such as AEC ('Dp_nm', 1:10000), AEC ('Dp_nm', [100 200 600 1900]), AEC ('Dp_nm', logspace(log10(1),log10(1000000),1000)) .
    3. The unit we use for particle size is nm
2. AEC can calculate the different type of sampler, tubing section and instruments respectively:
    1. Type in AEC('Dp_nm',logspace(log10(1),log10(1000000),1000),'B&L'), will calculate the efficiency of B&L type. We also provide 'Eddy', 'SMAI5', 'SMAI20' and 'BASE' types. NOTE:
        1. You cannot input two type at the same time. The program will show the error.
        2. Because we only have the efficiency data of SMAI under 5 lpm condition and 20 lpm condition, so you should type in 'SMAI5' or 'SMAI20' respect to these flow conditions.
        3. For B&L and 'Eddy' we use known equations to calculate the efficiency of aspiration and transmission, and the default value can be change by calling the AEC function or changing the values in the sampling.txt file.
        4. For 'SMAI5', 'SMAI20' and 'BASE' we directly give you the overall sampling efficiency of sampler, which is the 'ef_sampling_probe'. For 'B&L' and 'Eddy', we can give you the efficiency of aspiration (ef_asp) and transmission (ef_trans) and overall sampling efficiency (ef_sampling_probe).
        5. For example :Type in [Properties,Input,Others]=AEC('Dp_nm',logspace(log10(1),log10(1000000),1000),'SMAI5'), we get the efficiency of SMAI sampler at 5 lpm flow rate as:



2. For calculating the efficiency in tubing section:
    1. Type ‘overall_tubing’ to consider the efficiency in the tubing section. Otherwise, the output efficiency of tubing section will be one.
    2. You need to input all the information for each tubing section:
        1. ‘dt_mm’, the determined diameter of the tubing section (mm). In the paper, the first diameter of tubing should be the same as the d0. If not, a waring will appear. Moreover, each tubing section is defined by two diameters, so the number of tubing section is always equal to the length of dt_mm you typed in minus one. ‘dt_mm’,[10 10 30 20]
        2. ‘Qt’, Qt the flow rate in the tubing sections (l/min). In the paper, the flow rate is measured. ‘Qt’,[5 10 20]
        3. ‘L’, L the length of each tubing section (m). ‘L’,[1 0.5 1.5]
        4. ‘theta_i’, theta_i the inclination (o). If there is no inclination type zero for that section. ‘theta_i’,[10 35 0]
        5. ‘theta_Kr’, theta_Kr the angle of curvature (o), this is use for calculate the efficiency of inertial: bend, if you not input this, the code will set theta_Kr=zero. ‘theta_Kr’,[0 10 5]
        6. ‘theta_cont’, theta_cont the contraction half-angle (o), this is use for calculate the efficiency of inertial: contraction. If you not input this, the code will set theta_cont=zero. In addition, theta_cont only will use for the tubing section which the front diameter is higher than back diameter. For type in ‘dt_mm’, [10 10 30 20], the contraction half-angle should type in as ’theta_cont’, [0 0 15]. However, you can just make sure the theta_cont is at the right positions, because even you type some angle for the non-contraction section, we would not do the calculation.
        7. Note that ‘dt_mm’, ‘Qt’,’L’,’theta_i’,are the necessary inputs, ‘theta_Kr’ and ‘theta_cont’, are not necessary.
        8. For example :Type in [Properties,Input,Others]=AEC('Dp_nm',logspace(log10(1),log10(1000000),1000),'dt_mm',[10 30 20 10],'Qt',[10 5 15],'L',[0.3 0.4 0.5],'theta_i',[0 20 45],'theta_cont',[0 45 20],'theta_Kr',[0 20 45],'overall_tubing'), we get the efficiency of considering tubing will look like:

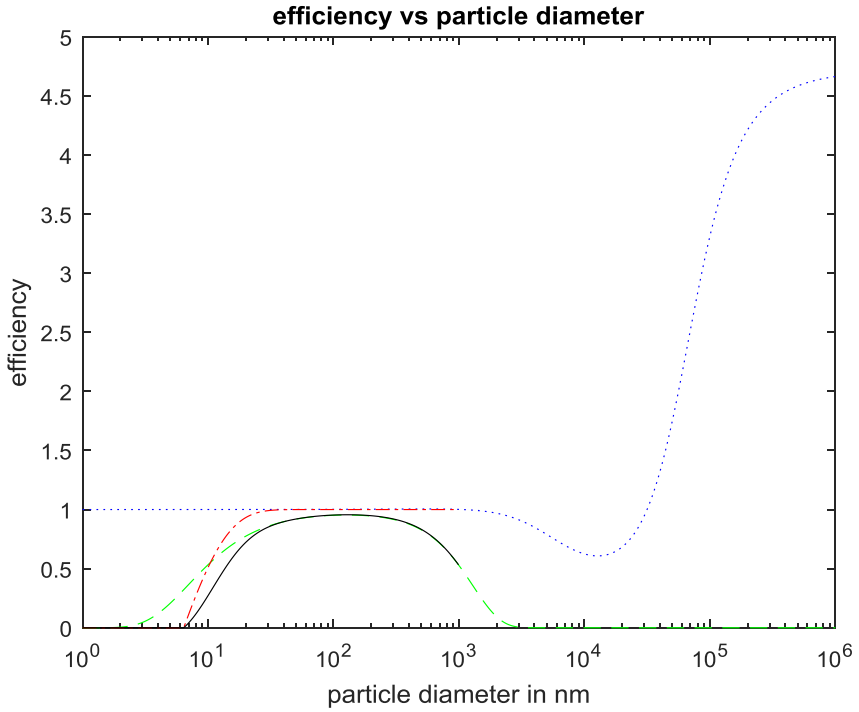


3. For calculating the efficiency of instruments:
    1. We give the efficiency of four types of instruments, ‘DMA’, ‘TSI_3010’,’TSI_3025’ and ’TSI_3786’. So you can type in like [Properties,Input,Others]=AEC('Dp_nm',logspace(log10(1),log10(1000000),1000),'DMA') ,and get the efficiency of ‘DMA’.
    2. All the default values of instrument give in instrument.txt file. You can change them by calling the AEC function or directly change in instrument.txt file.
    3. Example: type in [Properties,Input,Others]=AEC('Dp_nm',logspace(log10(1),log10(1000000),1000),'TSI_3025'), you can get



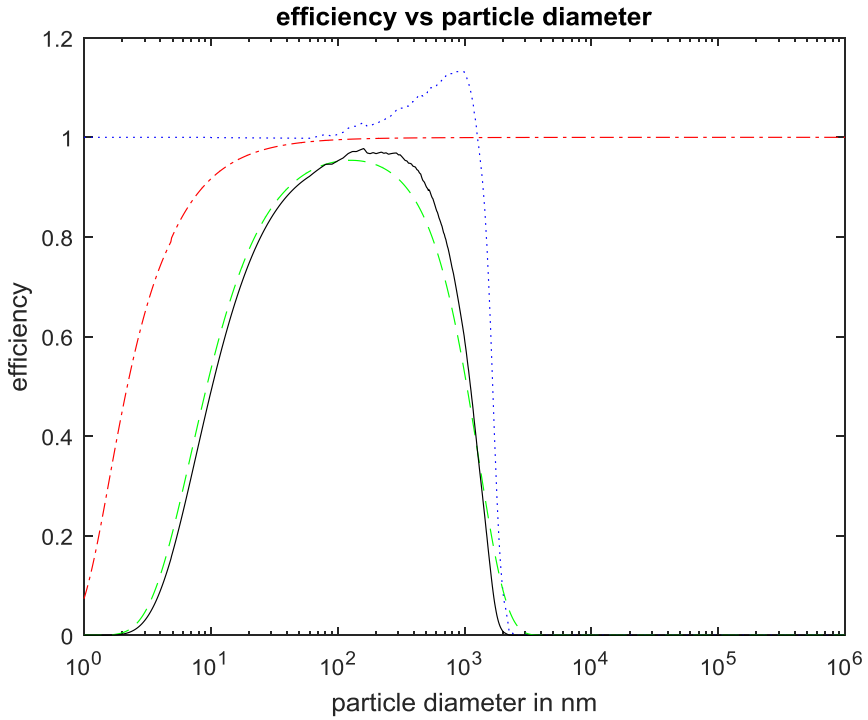
3. The AEC also can combine efficiency of samplers, tubing sections and instruments together. For example:

Type in:
[Properties,Input,Others]=AEC('Dp_nm',logspace(log10(1),log10(1000000),1000),'dt_mm',[10 30 20 10],'Qt',[10 5 15],'L',[0.3 0.4 0.5],'theta_i',[0 20 45],'theta_cont',[0 45 20],'theta_Kr',[0 20 45],'overall_tubing','Eddy','TSI_3010'), you can get



Type in:

[Properties,Input,Others]=AEC('Dp_nm',logspace(log10(1),log10(1000000),1000),'dt_mm',[10 30 20 10],'Qt',[10 5 15],'L',[0.3 0.4 0.5],'theta_i',[0 20 45],'theta_cont',[0 45 20],'theta_Kr',[0 20 45],'overall_tubing','BASE','DMA')



Notes:

1. Blue dot line is the efficiency of sampling probe; green dash line is the efficiency of tubing section; red dot dash line is the efficiency of instrument; real black line is the overall efficiency.
2. If you just input one or two particles, like AEC('Dp_nm', 100) or AEC('Dp_nm', [100 500]), the function will not show the figure, but the report. Once the number of input particle higher than three, the function will show you the report and the figure. If you want to see the figure, we recommend the number of your input particles higher than 100.

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2/11/17