CLAIMS

What is claimed is:

1. A method for humidification of a vaporizable component from a feed liquid into a carrier gas, the method comprising:

flowing the feed liquid including the vaporizable component into a second-stage humidifier chamber of a multi-stage humidifier to form a second-stage humidifier bath at a second humidification temperature;

flowing a first remnant of the feed liquid from the second-stage humidifier chamber into a first-stage humidifier chamber of the multi-stage humidifier to form a first-stage humidifier bath at a first humidification temperature, wherein the first humidification temperature is lower than the second humidification temperature, wherein the first-stage humidifier bath is separated from the second-stage humidifier bath via a sparger plate;

removing a second remnant of the feed liquid from the first-stage humidifier chamber;

injecting the carrier gas into the first-stage humidifier bath in the first-stage chamber and bubbling the carrier gas through the feed liquid in the first-stage humidifier bath, where the carrier gas collects the vaporizable component in vapor form from the first remnant of the feed liquid to partially humidify the carrier gas with the vaporizable component, and wherein a top gas region comprising the partially humidified carrier gas forms above the first-stage humidifier bath in the first-stage humidifier chamber;

flowing the partially humidified carrier gas from the top gas region of the first humidifier chamber directly through the sparger plate into the second-stage humidifier bath in the second-stage humidifier chamber and bubbling the carrier gas through the second-stage humidifier bath, where the carrier gas collects more of the vaporizable component in vapor form from the feed liquid to further humidify the carrier gas with the vaporizable component, wherein the partially humidified carrier gas in the top gas region of the first-stage humidifier chamber has a pressure greater than a hydrostatic pressure of the second-stage humidifier bath, and wherein the first- and second-stage humidifier baths maintain a majority liquid phase when the carrier gas is bubbled through the baths; and

removing the humidified carrier gas from the second-stage humidifier chamber.

2. The method of claim 1, wherein the feed liquid that flows into the second-stage humidifier chamber is a remnant of a liquid from a third-stage humidifier bath at a third humidification temperature in a third-stage humidifier chamber, wherein the third humidification temperature is higher than the second humidification temperature, the method further comprising directing the humidified carrier gas from the second-stage humidifier chamber into the third-stage humidifier bath in the third-stage humidifier chamber and bubbling the humidified carrier gas through the third-stage humidifier bath, where the humidified carrier gas is further humidified with more of the vaporizable component in vapor form from the third-stage bath.

3. The method of claim 1, wherein the multi-stage humidifier is an integral structure, wherein the partially humidified carrier gas passes directly from the first-stage humidifier chamber through the sparger plate into the second-stage humidifier bath in the second-stage humidifier chamber without exiting the integral structure.

4. The method of claim 3, wherein the stages are separated only by the sparger plate.