Claims

1. Method for obtaining low molecular weight heparins (LMWH) with an average molecular weight distribution of between ~~approximately~~ 3.0 and ~~approximately~~ 5.0 kDa comprising the following steps:

a) providing a crude depolymerized heparin solution; and ~~with an oligosaccharide chain distribution range of between approximately 0.6 and approximately 10 kDa; and a heparin concentration of up to approximately 4% w/v;~~

b) performing at least one concentration step by aqueous phase tangential flow filtration (TFF) using a nominal cut-off 1 kDa membrane to achieve a heparin concentration of ~~up~~ between 5% w/v and ~~to approximately~~ 25% w/v, thereby obtaining said LMWH~~.~~

wherein the crude depolymerized heparin solution of step a) has an oligosaccharide chain distribution range of between 0.6 and 10 kDa and a heparin concentration of between 3% w/v and 4% w/v.

2. Method according to claim 1, wherein step (b) is performed a first concentration step by TFF to achieve a heparin concentration of up to ~~approximately~~ 10% w/v and a second concentration step by TFF to achieve a heparin concentration of between ~~approximately~~ 10% and ~~approximately~~ 25% w/v.

3. Method according to claim 2, wherein the second concentration step is performed to a heparin concentration of between ~~approximately~~ 12% and ~~approximately~~ 22% w/v.

4. Method according to any one of claims 1 to 3, wherein a step of clarifying the heparin solution of step (a) is performed.

5. Method according to any one of claims 1 to 4, wherein at least one depth filtration step is performed.

6. Method according to claim 5, wherein the depth filtration step is performed prior to the TFF concentration step if only one is performed, or prior to the first TFF concentration step if more than one TFF concentration step is performed.

7. Method according to claim 6, wherein the depth filtration step is performed subsequently to the TFF concentration step if only one is performed, or prior to the first TFF

concentration step if more than one TFF concentration step is performed.

8. Method according to any one of claims 1 to 7, wherein at least one step of diafiltration with water is performed.

9. Method for obtaining heparins according to claim 8, wherein the diafiltration step is performed prior to the TFF concentration step if only one is performed, or prior to the first TFF concentration step if more than one TFF concentration step is performed.

10. Method according to any one of claims 1 to 9, comprising at least one step of treating with H_2O_2.

11. Method according to claim 10, wherein the H_2O_2 treatment step is performed subsequently to the TFF concentration step if only one is performed, or prior to the first TFF concentration step if more than one TFF concentration step is performed.

12. Method according to claim 10, wherein the H_2O_2 treatment step is performed prior to the TFF concentration step if only one is performed, or prior to the first TFF concentration step if more than one TFF concentration step is performed.

13. Method according to any one of claims 1 to 12, wherein a step of lyophilizing the obtained concentrate is performed.

14. Method according to any one of claims 1 to 13, wherein the crude depolymerized heparin has not been obtained by fractional precipitation.

15. Method according to any one of claims 1 to 14, wherein the entire method excludes fractional precipitation of the heparin.

16. Method according to any one of claims 1 to 15, wherein the molecular weight (Mw) of the LMWH obtained is in the following ranges

	Mw, Da	M1 <2000 Da, %	M2 2000-8000 Da, %	M3 >8000 Da, %
LMWH	3800-5000	12.0-20.0	68.0-82.0	≤18.0.

17. Method according to any one of claims 1 to 16, wherein the molecular weight (Mw) of the crude depolymerized heparin is in the following ranges

	Mw, Da	M1 <2000 Da, %	M2 2000-8000 Da, %	M3 >8000 Da, %
crude depolymerized heparin	3000-5000	≤25	60-80	≤20.

18. Method according to any one of claims 1 to 15, wherein the molecular weight (Mw) of the LMWH obtained is in the following ranges

	Mw, Da	M1 <2000 Da, %	M2 2000-6000 Da, %	M3 >6000 Da, %
LMWH	3000-4200	<35.0	50.0-75.0	<15.0.

19. Method according to any one of claims 1 to 15 or 18, wherein the molecular weight (Mw) of the crude depolymerized heparin is in the following ranges

	Mw, Da	M1 <2000 Da, %	M2 2000-6000 Da, %	M3 >6000 Da, %
crude depolymerized heparin	2500-5000	<40	50-75	<25.

20. Method according to any one of claims 1 to 19, wherein the concentration by tangential flow filtration (TFF) employs a 0.7 to 1 kDa membrane.

21. Method according to claim 20, wherein a 0.9 to 1 kDa, preferably 1kDa, is employed.

22. Method according to any one of claims 1 to 21, wherein the heparin is enoxaparin sodium.